BOCHVAR, A. A., KUZNETSOVA, V. G. and SERGEYEV, V. S.

"γ-Uranium Self-Diffusion."

paper to be presented at 2nd UN Intl.' Conf. on the peaceful uses of Atomic Energy, Geneva, 1 - 13 Sept 58.

BOCHVAR, A. A.

"The Effect of Thermal Cycling on Dimensional and Structural Stability of Various Metals and Alloys", by A. A. Bochvar, G. J. Sergeyev, A. A. Yulkova, L. I. Kolobneva, G. I. Tomson.

Report presented at 2nd UN Atoms-for-Peace Conference, Geneva, 9-13 Sept 1958

BOCHVAR, A. A.

18(0) PHASE I BOOK EXPLOITATION SOV/1728

Akademiya nauk SSSR. Institut metallurgii

Sovremennyye problemy metallurgii (Modern Problems in Metallurgy) Moscow, Izd-vo AN SSSR, 1958. 640 p. 3,800 copies printed.

Resp. Ed.: A.M. Samarin, Corresponding Member, USSR Academy of Sciences; Eds. of Publishing House: V.S. Rzhevnikov, and A.N. Dernov; Tech. Ed.: T.V. Polyakova.

PURPOSE: This book is intended for scientific and technical personnel in the field of metallurgy.

COVERAGE: This is a collection of articles on certain aspects of Soviet metallurgy. The book is dedicated to Academician Ivan Pavlovich Bardin on the occasion of his 75th birthday. The book is divided into seven parts. The first part consists of two articles presenting a brief account of the biography and professional activity of the Soviet metallurgist. It includes an article by John Chipman, Nicholas Grant, and John Elliott (M.I.T., USA) describing their meeting with Bardin in Moscow and also his visit to the United States. The second part consists of three articles and deals with raw materials and fuels for the Soviet metallurgical industry. The third part represents the major portion of the book. It consists of 25 articles dealing with the various aspects of the metallurgy of pig iron and steel. The fourth part consists of two articles treating the metallurgy of nonferrous metals. The fifth part consists of three articles on the forming of metals. The sixth part consists of eight articles discussing certain aspects of physical metallurgy. The last part deals with general problems in the field of metallurgy. References are given after each article. No personalities are mentioned.

TABLE OF CONTENTS:

Modern Problems in Metallurgy SOV/1728

FORMING OF METALS

SCIENCE OF METALS

Card 10/12

6

BOCHVAR, A.A.; TITOVA, A.S.

Diffusion of hardening elements from duralumin-type alloys into aluminum. Izv. vys. ucheb. zav.; tsvet. met. no.1:127-129 '58. (MIRA 11:6)

1. Moskovskiy institut tsvetnykh metallov i zolota. Kafedra metallovedeniya.

(Diffusion) (Aluminum) (Duralumin)

AUTHORS: Bochvar, A.A., Tomson, G.I., Chebotarev, N.T. SOV/89-4-6-7/30

TITLE: Recrystallization of Uranium Subjected to the Action of a Cyclical Thermal Treatment (Rekristallizatsiya urana pod deystviyem tsiklicheskoy termoobrabotki)

PERIODICAL: Atomnaya energiya, 1958, Vol. 4, Nr 6, pp. 555-556 (USSR)

ABSTRACT: Recrystallization was investigated in the case of three types of uranium, i.e. uranium that had been hardened in the γ-phase, uranium drawn in the γ-phase, and in molten uranium. Cyclical thermal treatment had the following parameters:
Maximum temperature 540-550° C; minimum temperature 100° C; average velocity of heating 22°/s; average velocity of cooling 25°/s; time of heating at maximum temperature 12 - 13 s.
Microstructure was obtained by electrolytic etching in the following solution:
Acetic acid - 1 part; saturated aqueous solution of chromium anhydride (specific weight 1.50) - 1 part; water - 2 parts.
X-ray pictures were taken by means of the device RKU-86 with cobalt radiation.
Recrystallization leads to a pulverization of the initial

Card 1/2

Recrystallization of Uranium Subjected to the Action of a Cyclical Thermal Treatment SOV/ 89-4-6-7/30

structure. It begins at those parts of the crystal lattice which are exposed to the highest degree of disturbance. There are 5 figures and 6 references, 3 of which are Soviet.

SUBMITTED: March 18, 1958

1. Uranium--Phase studies 2. Uranium--Crystallization
3. Uranium--Heat treatment

Card 2/2

AUTHORS: Bochvar, A. A., Konobeyevskiy, S. T., Zaymovskiy, A. S., Sergeyev, G. Ya., Kutaytsev, V. I., Pravdyuk, N. F., Levitskiy, B. M. SOV/89-5-1-1/28

TITLE: Investigations Carried out in the Field of the Metallography of Plutonium, Uranium, and Their Alloys (Issledovaniya v oblasti metallovedeniya plutoniya, urana i ikh splavov)

PERIODICAL: Atomnaya energiya, 1958, Vol. 5, Nr 1, pp. 5-23 (USSR)

ABSTRACT: In the course of the present survey the principal investigations
ABSTRACTS: The purpose of this survey is to study the metallography of nuclear fuels: plutonium, uranium, and their alloys, are mentioned. The work concerned was carried out in connection with the development of atomic power engineering in the USSR. Three principal chapters contain data concerning the following subjects:
1.) Plutonium and its alloys:
a) Metallic plutonium
b) Alloys with the metals of group I ($PuCu_2$, $PuCu_4$, $PuCu_6$)
c) Alloys with the metals of group II ($PuBe_{13}$)
d) Alloys with the elements of group III (Pu_3Al, $PuAl_2$, $PuAl_3$, $PuAl_4$)

Card 1/3

e) Alloys with the elements of group IV (Pu_6Zr)
f) Alloys with the elements of group V-VIII (PuV_2, $PuOs_2$, $PuFe_2$)
g) Alloys with the metals of actinides (PuU)

2.) Uranium and its alloys:
a) Structure and physical properties of uranium
b) Mechanic properties of coarse-grained uranium
c) Deformation of uranium when subjected to irradiation or cyclic thermal treatment
d) Change of the structure and properties of uranium as a result of thermal treatment (annealing)
e) Change of the structure and properties of uranium as a result of plastic deformation followed by annealing at temperatures of the α-range
f) Structure and properties of uranium alloys
g) Treatment of uranium by means of pressure.

3.) The influence exercised by neutron radiation upon the structure and the properties of reactor building materials and fuels. There are 17 figures, 6 tables, and 6 references, which are Soviet.

Investigations Carried out in the Field of the Metallography of Plutonium, Uranium, and Their Alloys SOV/89-5-1-1/28

SUBMITTED: March 18, 1958

1. Plutonium--Analysis 2. Plutonium alloys--Analysis 3. Uranium--Analysis 3. Uranium-alloys--Analysis 4. Reactors --Materials 5. Materials--Effects of radiation

Card 3/3

SOV/89-5-3-9/15

AUTHORS: Bochvar, A. A., Konobeyevskiy, S. T., Kutaytsev, V. I., Men'shikova, T. S., Chebotarev, N. T.

TITLE: The Reactions of Plutonium With Other Metals With Respect to Their Position in the Periodic Table of D. I. Mendeleyev (Vzaimodeystviye plutoniya s drugimi metallami v svyazi s ikh raspolozheniyem v periodicheskoy sisteme D. I. Mendeleyeva)

PERIODICAL: Atomnaya energiya, 1958, Vol. 5, Nr 3, pp. 303-309 (USSR)

ABSTRACT: On the basis of phase diagrams the character of the interaction of plutonium with a number of other elements of the periodic table is described. Only characteristic examples are mentioned. Phase diagrams are given for the following alloys: Pu + Cu, Pu + Be, Pu + Al, Pu + Pb, Pu + Bi, Pu + Zr, Pu + Cr, Pu + Fe, Pu + Mo, Pu + Os, Pu + F, Pu + U. A detailed list of data concerning the crystal structure of some plutonium compounds is added, in which plutonium is combined with the following elements: Cu, Ag, Be, Mg, Hg, Al, In, Ta, C, Si, Ge, Sn, Pb, Zr, P, As, Bi, Te, Mn, Fe, Co, Ni, Os, Th, and Ur (Soviet and foreign data). For the compilation of the phase diagrams especially the papers by the authors mentioned above in the first

Card 1/2

The Reactions of Plutonium With Other Metals With Respect to Their Position in the Periodic Table of D. I. Mendeleyev

were used. The collaborators V. I. Bagrova, O. S. Ivanov, G. N. Smotritskiy, and Ye. S. Smotritskaya are mentioned separately. There are 12 figures and 5 references, 1 of which is Soviet.

SOV/24-58-10-22/34

AUTHORS: Bochvar, A. A., Sviderskaya, Z. A. (Moscow)

TITLE: Investigation of the Softening of Gold-Copper Solid Solutions (Issledovaniye protsessov razuprochneniya tverdykh rastvorov zoloto-med')

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, 1958, Nr 10, pp 125-127 (USSR)

ABSTRACT: Diffusion processes play an important part in hardening and softening of metals and alloys at high temperatures, and in all changes in the solid state. In order to verify the assumption that diffusion and order-and disorder-establishment in a solid solution at high temperatures is accompanied by an increase in plasticity, i.e. increase in creep at those temperatures, two Au-Cu alloys (51% Au and 76% Au) were studied. In Fig.1 the Cu-Au thermal equilibrium diagram is reproduced, in which the regions of inter-metallic compound formation (Cu_3Au and CuAu) are also indicated. The formation (order establishment) temperature for Cu_3Au on cooling is 396°C and for CuAu 424°C. The change in micro-hardness with time at various

Card 1/3

Investigation of the Softening of Gold-Copper Solid Solutions

temperatures was used for studying creep. The 51% Au alloy (Cu_3Au) was studied during its transition from the disordered to the ordered state and the 76% Au alloy (CuAu) only during disorder establishment. The results are given in a table, and graphically in Figs.2 and 3. Although in long term loading the micro-hardness decreases with increase in temperature, in short term tests it slightly increases up to about 300°C, after which it drops sharply. In similar tests for pure copper and gold specimens, the microhardness falls with rise in temperature in both long and short term tests, but in the latter retardation occurs at about 300°C. As compared with Al-Zn alloys, AuCu alloys creep at a considerably lower rate, but they soften at 300-400°C much more readily than the respective pure metals, probably owing to the melting point of the alloys being lower than those of the pure metals. The fact that the yield strength of AuCu alloys during order and disorder establishment does not drop sharply is a proof that normal diffusion, involving shifting of atoms, alone cannot bring about rapid softening and increase in plasticity at high temperatures. It is likely that in order to ensure a sufficient degree of diffusion and to increase plasticity,

Investigation of the Softening of Gold-Copper Solid Solutions

displacement of atoms at the boundary surfaces of two phases at the point of change in solubility with temperature, or in the boundaries of separate crystallites of the same phase, may have to take place during recrystallisation. In order and disorder establishment processes occurring throughout the entire volume of solid solution alloys, the transfer of particles appears to be too slow to heal the beginnings of breakdown of structure during deformation, and hence these alloys have no great plasticity and yield strength in tension. There are 3 figures and 1 table.

SUBMITTED: May 5, 1958.

Card 3/3

SOV/129-58-11-5/13

AUTHORS: Bochvar, A.A., Academician, Drits, M. Ye., Candidate of Technical Sciences, Sviderskaya, Z. A. and Kadaner, E.S.

TITLE: Influence of the Temperature and of the Preliminary Heat Treatment on the Long Duration Strength of a Cast and Deformed Alloy (Vliyaniye temperatury i predvaritel'noy termicheskoy obrabotki na dlitel'nuyu prochnost' litogo i deformirovannogo splava)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 11, pp 32-37 (USSR)

ABSTRACT: The authors investigated the differences in the changes of the high temperature characteristics of a cast and deformed alloy of the system Mg-Mn-Al-Ca containing 1.5% Mn, 0.5% Al, 0.3% Ca and rest Mg (Ref 1). Specimens cast in earthen moulds as well as specimens of the same composition after pressing in the hot state with a deformation of 90% were investigated. The changes were studied of long duration strength on various testing times at elevated temperatures. The long duration strength values determined on the basis of testing five or six specimens for each point are entered in Table 1; the graphs Fig.1 show the change of the long duration

Card 1/3

Influence of the Temperature and of the Preliminary Heat Treatment on the Long Duration Strength of a Cast and Deformed Alloy

strength of the cast (top graph) and the deformed (bottom graph) alloy as a function of the temperature and testing time and it can be seen that there is a considerable difference between the two sets of curves, the cast structure being the more stable one. To establish the magnitude of the possible deviations of the long duration strength of an alloy in the two structural states, the authors investigated the influence of preliminary heating within a wide range of temperatures (150 to 600°C). Up to 450°C the annealing was effected in air using a magnesium oxide cover. Heating to 500 and 600°C was effected in sealed quartz ampules from which the air was evacuated. In both cases the heating time was 24 hours. The results are entered in Table 2. In Fig.2 the dependence is graphed of the long duration strength of the cast and the deformed Mg-Mn-Al-Ca alloy as a function of the preliminary heating temperature for both states. In the case of the structure obtained by casting, high temperature heating intensifies the tendency to creep, whilst in the case of a structure

Influence of the Temperature and of the Preliminary Heat Treatment on the Long Duration Strength of a Cast and Deformed Alloy

produced by deformation the same heating will bring about an improvement in the heat resistance. The process of recrystallisation, which is effected as a result of displacement of the atoms from one crystal to the other, intensifies the creep of the deformed material if the first stages of this process proceed directly during heat resistance tests. However, if recrystallisation is effected earlier by means of heating at a sufficiently high temperature of the deformed alloy, then the recrystallisation will have a positive influence on the heat resistance due to the creation of a more stable structure and a reduction of the division surfaces which serve as foci of diffusional displacements. There are 4 figures, 2 tables and 4 Soviet references.

ASSOCIATION: Institut metallurgii AN SSSR (Institute of Metallurgy, Ac.Sc., USSR)

Card 3/3 1. Alloy castings--Mechanical properties 2. Alloy castings--Heat treatment 3. Alloy castings--Temperature factors 4. Alloys--Deformation

SOV/20-121-1-24/55

AUTHORS: Bochvar, A. A., Member, Academy of Sciences, USSR, Zuykova, A. A.

TITLE: On the Behaviour of β-Brass Plates Subjected to Cyclic Thermal Treatment (O povedenii plastin iz β-latuni pri tsiklicheskoy termicheskoy obrabotke)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 121, Nr 1, pp. 91-92 (USSR)

ABSTRACT: According to a previous investigation (Ref 1) the occurrence of the β-phase in the structure of the alloy does not only change the amount but also changes the sign of the effect of the cyclic heat treatment. It remained unexplained by what the strong influence of the comparatively small increase in zinc content in the alloy (e.g. from 38 to 40%) is caused. For the solution of this problem it must be known how the plates of pure β-phase behave during a cyclic heat tretment. Therefore pure β-brass with 47% of zinc (in the structure of which were neither an α- nor a β-phase) was produced. Of this alloy cast and rolled plates (5 • 25 • 100 mm) were produced, heated to 600° for 2,5 minutes, and quenched in water. The cast as well as the rolled

Card 1/3

On the Behaviour of β-Brass Plates Subjected to Cyclic Thermal Treatment SOV/20-121-1-24/55

plates of β-brass after a different number of cycles became much shorter, thicker, and partly also wider. There was no essential difference in the behaviour of the cast and of the rolled plates. A decrease in surface on occasion of the cyclic heat treatment is characteristic for plates of pure β-phase. The sign of the effect of the cyclic heat treatment in brass in the case of increasing zinc content (above 38-39%) changes, according to the obtained data, as a consequence of all properties of the β-phase occurring in the structure. This β-phase has a cubic volume-centered lattice. There are 2 figures and 1 reference, [illegible] which is Soviet.

ASSOCIATION: Moskovskiy institut tsvetnykh metallov i zolota im. M. I. Kalinina (Moscow Institute of Nonferrous Metals and Gold imeni M. I. Kalinin)

SUBMITTED: April 2, 1958

Card 2/3

On the Behaviour of β-Brass Plates Subjected to Cyclic Thermal Treatment SOV/20-121-1-24/55

1. Brass--Heat treatment 2. Brass--Phase studies 3. Heat--Metallurgical effects
4. Brass--Thermodynamic properties

Card 3/3

BOCHVAR, A.A.

21(4) PHASE I BOOK EXPLOITATION SOV/2714

International Conference on the Peaceful Uses of Atomic Energy. 2nd, Geneva, 1958

Doklady sovetskikh uchenykh; yadernoye goryucheye i reaktornyye metally. (Reports of Soviet Scientists; Nuclear Fuel and Reactor Metals) Moscow, Atomizdat, 1959. 670 p. (Series: Its: Trudy, vol. 3. 8,000 copies printed.

Ed. (Title page): A.A. Bochvar, Academician, A.P. Vinogradov, Academician, V.S. Yemel'yanov, Corresponding Member, USSR Academy of Sciences, and A.P. Zefirov, Doctor of Technical Sciences; Ed. (Inside book): V.V. Pereverzev and O.M. Pchelintseva; Tech. Ed.: E.I. Mazel'.

PURPOSE: This volume is intended for scientists, engineers, physicians, and biologists working in the production and peaceful application of atomic energy; for professors and students of schools of higher technical education where the subject is taught; and for people interested in atomic science and technology.

COVERAGE: This is volume 3 of a 6-volume set of reports on atomic energy, presented by Soviet scientists at the Second International Conference on the Peaceful Uses of Atomic Energy, held in Geneva from September 1 to 13, 1958. Volume 3 consists of two parts. The first part, edited by A.I. Zubov, is devoted to geology, prospecting, concentration and processing of nuclear source material. The second part, edited by G.L. Zverev, includes 27 reports on metallurgy, metallography, processing technology of nuclear fuels and reactor metals, and neutron irradiation effects on metals. The titles of the individual papers in most cases correspond word for word with those in the official English language edition on the Conference proceedings. See SOV/2081 for the titles of the other volumes of the set.

Card 7/11

BOCHVAR, A.A.

21(4) PHASE I BOOK EXPLOITATION SOV/2714

International Conference on the Peaceful Uses of Atomic Energy. 2nd, Geneva, 1958

Doklady sovetskikh uchenykh; yadernoye goryucheye i reaktornyye metally. (Reports of Soviet Scientists; Nuclear Fuel and Reactor Metals) Moscow, Atomizdat, 1959. 670 p. (Series: Its: Trudy, vol. 3. 8,000 copies printed.

Ed. (Title page): A.A. Bochvar, Academician, A.P. Vinogradov, Academician, V.S. Yemel'yanov, Corresponding Member, USSR Academy of Sciences, and A.P. Zefirov, Doctor of Technical Sciences; Ed. (Inside book): V.V. Pereverzev and G.M. Pchelintseva; Tech. Ed.: E.I. Mazel'.

PURPOSE: This volume is intended for scientists, engineers, physicians, and biologists working in the production and peaceful application of atomic energy; for professors and students of schools of higher technical education where the subject is taught; and for people interested in atomic science and technology.

COVERAGE: This is volume 3 of a 6-volume set of reports on atomic energy, presented by Soviet scientists at the Second International Conference on the Peaceful Uses of Atomic Energy, held in Geneva from September 1 to 13, 1958. Volume 3 consists of two parts. The first part, edited by A.I. Zubov, is devoted to geology, prospecting, concentration and processing of nuclear source material. The second part, edited by G.L. Zverev, includes 27 reports on metallurgy, metallography, processing technology of nuclear fuels and reactor metals, and neutron irradiation effects on metals. The titles of the individual papers in most cases correspond word for word with those in the official English language edition on the Conference proceedings. See SOV/2081 for the titles of the other volumes of the set.

Sinel'nikov, K.D., V. Ye. Ivanov, V.M. Amonenko, and V.D. Burlakov. Refining Beryllium and Other Metals by Condensation on Heated Surfaces (Report No. 2051) 526

Ivanov, Ye.S., and V.M. Shmelev. Melting and Casting of Beryllium (Report No. 2048) 536

Vol'skiy, A.N., N.V. Vyatkina, E.F. Zverev, N.L. Kal'tman, and T.S. Posobilo. Production of Chemically Pure Strontium, Barium, Magnesium, and Calcium (Report No. 2050) 542

Bochvar, A.A., G.Ya. Sergeyev, A.A. Zhul'kova, L.I. Kolobneva, and G.I. Tomson. Effect of Thermal Cycling and Cooling on the Dimensional and Structural Stability of Various Metals and Alloys (Report No. 2190) 554

Zaymovskiy, A.S., G.Ya. Sergeyev, V.V. Titova, B.M. Levitskiy, and Yu.N. Sokurskiy. Influence of the Structure and Properties of Uranium on Its Behavior Under Irradiation (Report No. 2191) 573

Card 9/11

BOCHVAR, A.A., akademik, red.; YEMEL'YANOV, V.S., red.; ZVEREV, G.L., red. toma; IVANOV, A.N., red. toma; SOKURSKIY, Yu.N., red. toma; STERLIN, Ya.M., red. toma; PEREVERZEV, V.V., red.; PCHELINTSEVA, G.M., red.; MAZEL', Ye.I., tekhn. red.

[Transactions of the International Conference On The Peaceful Uses of Atomic Energy] Trudy Vtoroy mezhdunarodnoy konferentsii po mirnomu ispol'zovaniyu atomnoy energii, 2d, Geneva, 1958. Izbrannye Doklady inos rannykh uchenykh. Moskva, Izd-vo Glav. uprav. po ispol'zovaniiu atomnoi energ. pri Sovete Ministrov SSSR. Vol.6. [Nuclear fuel and ractor materials] IAdernoe goriuchee i reaktornye materialy. Pod obshchei red. A.A.Bochvara i Emel'ianova V.S. 1959. 702 p.
(MIRA 14:10)

1. International Conference on The Peaceful Uses of Atomic Energy. 2d, Geneva, 1958. 2. Chlen-korrespondent AN SSSR (for Yemel'yanov). (Nuclear fuels) (Nuclear reactors—Materials)

18.7100

SOV/180-59-5-8/37

AUTHORS: Bochvar, A.A., Zuykova, [redacted] (Moscow)

TITLE: On the Reason for the Different Behaviour of Cubic Metals in Cyclic Thermal Treatment

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 5, pp 54-56 (USSR)

ABSTRACT: In order to elucidate the role of deformation in the core, investigations of the cyclic thermal treatment (c.t.t.) effect were carried out on cylindrical β-brass specimens with bores drilled along their length (curve 2, Fig 1). In order to ensure uniform cooling conditions as compared with a solid cylinder (curve 1), the ends of the drilled specimens were welded up. As the number of cycles is increased the change in sign of the effect is associated with recrystallization and possibly oxidation. In β-brass recrystallization takes place under the influence of c.t.t. which leads to a considerable grain growth after approximately 140 cycles between 600 and 20 °C for the solid cylinder (curve 1), which coincides with the beginning of strong contraction of the specimen along its length. Simultaneously as the number of cycles increases the oxide film thickens. In subsequent investigations plates of β-brass (5 x 25 x 100 mm) were subjected to

Card 1/3

On the Reason for the Different Behaviour of Cubic Metals in Cyclic Thermal Treatment

c.t.t. in different temperature ranges with the aim of lowering the yield point of the metal in the surface layers of the specimen and thus to decrease the ratio of σ_s in the extended and compressed zones. A lowering in yield point in the surface layer at the starting point of cooling was attained by raising the temperature of the cooling medium. In Fig 2 the change in length of the specimen in percent after 100 cycles between 600 and 20°C with cooling in oil is shown by point 1, with cooling in oil heated to 100 °C by point 2, and the change in length of the specimens cooled in potassium nitrate maintained at 200 and 400 °C by points 3 and 4 respectively. The small difference in cooling rate between points 1 and 2 did not exert a noticeable influence on the c.t.t. effect. The c.t.t. effect for β-brass at a constant temperature drop of the media (400°C) is shown in Fig 3. Hence the considerable lowering in yield stress of β-brass in its surface layers at a minimum cyclic temperature of 200 °C (Ref 6), i.e. a decrease in the relationship between the yield stresses of the extended and contracted zones,

On the Reason for the Different Behaviour of Cubic Metals in Cyclic Thermal Treatment

causes tensional plastic deformation of sufficient magnitude to lead to a general elongation of the specimen similar to that met with in metals with a face-centred cubic lattice. As could be expected from the point of view of the above assumptions, a c.t.t. of aluminium plates under similar conditions did not result in a change of sign of the effect.

Card 3/3

There are 3 figures and 9 Soviet references.

SUBMITTED: June 18, 1959

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SOV/180-59-6-4/31

AUTHORS: Bochvar, A.A., Novikov, I.I., and Kholmyanskiy, V.A. (Moscow)

TITLE: Dimensional Changes in Flat Specimens of Alloys of the Cu-Ni System due to Cyclic Temperature Fluctuations

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 6, pp 21-23 (USSR)

ABSTRACT: It has been shown (Ref 1) that specimens of metals, characterized by cubic crystal lattice and, consequently, being isotropic in respect of the thermal expansion, may nevertheless undergo an irreversible change of their dimensions when subjected to cyclic thermal treatment; the magnitude of these changes, which are an accumulative effect of plastic deformation due to thermal stresses, should depend on the ratio between the magnitude of these stresses and the yield point of the alloy; since the mechanical properties and those physical characteristics upon which depends the magnitude of thermal stresses, change with the composition of the alloy, it follows that, all other factors being equal, the thermally induced dimensional changes of alloys of a given system should be a function of the composition of these alloys, and the

Card 1/4

Dimensional Changes in Flat Specimens of Alloys of the Cu-Ni System due to Cyclic Temperature Fluctuations

object of the present investigation was to study this relationship in the alloys of the Cu-Ni system. The experimental specimens, in the form of flat strips measuring 100 x 20 x 3 mm, were cut from cold-rolled sheet. One heat treatment cycle consisted in holding the specimen at the test temperature for 7 min and water quenching. The length of the specimens was measured (with accuracy of 0.1 mm) after 25, 50, and 75 cycles. The results of the first series of experiments, in which all specimens were quenched from 750 °C, are reproduced in Fig 1, where the increase in length of the specimen ($\Delta\ell$, %) is plotted against the number, n, of the heat-treating cycles for the Ni, 25% Cu-Ni, 50% Cu-Ni, 75% Cu-Ni, and Cu specimens (curves 1-5, respectively). It will be seen that in each case $\Delta\ell$ increased linearly with n. The results of the next series of experiments are plotted in Fig 2a, where $\Delta\ell$ (after 75 cycles) is plotted against the composition of the alloy for specimens quenched from 750 °C (curve 1) and from a temperature 180 °C higher than the recrystallization

Dimensional Changes in Flat Specimens of Alloys of the Cu-Ni System due to Cyclic Temperature Fluctuations

temperature of the alloy of a given composition (curve 2); graph a in Fig 2 shows the constitution diagram of the Cu-Ni system; graph б shows the composition dependence of the recrystallization temperature (°C); the curve shown in graph в illustrates the concentration dependence of σ/k, calculated from the Timoshenko formula $\sigma = k E\alpha/\lambda(1-\mu)$, where σ is thermal stress in the elastic deformation zone, α is the linear coefficient of thermal expansion, E is Young's modulus, λ is heat conductivity, μ is Poisson ratio, k is proportionality coefficient. Finally, graph г shows the concentration dependence of hardness (kg/mm^2) of the Cu-Ni alloys. Analysis of the obtained results, considered in conjunction with the data illustrated in Figs 2a, б, в, г, led the authors to the conclusion that the effect of the composition of a solid solution on the magnitude of the thermally induced, permanent dimensional changes, can be qualitatively interpreted in terms of the concentration dependence of the physical and mechanical properties of the alloys.

Card 3/4

67928
SOV/180-59-6-4/31

Dimensional Changes in Flat Specimens of Alloys of the Cu-Ni System due to Cyclic Temperature Fluctuations

There are 2 figures and 3 Soviet references.

SUBMITTED: June 29, 1959

Card 4/4

BOCHVAR, A.A.
P.2

PHASE I BOOK EXPLOITATION SOV/3602

Akademiya nauk SSSR. Institut metallurgii

Issledovaniye splavov tsvetnykh metallov; sbornik 2 (Analysis of Nonferrous Metal Alloys; Collection of Articles, [No.] 2) Moscow, Izd-vo AN SSSR, 1960. 204 p. Errata slip inserted. 2,800 copies printed.

Ed.: I.A. Oding, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: V.S. Rzheznikov; Tech. Ed.: T.P. Polenova; Editorial Board: A.A. Bochvar, Academician; M.Ye. Drits, Candidate of Technical Sciences (Deputy Resp. Ed.); M.V. Zakharov, Professor, Doctor of Technical Sciences; E.S. Kadaner, Candidate of Technical Sciences (Resp. Secretary); A.M. Korol'kov, Doctor of Technical Sciences; M.V. Mal'tsev Professor, Doctor of Technical Sciences; and Z.A. Sviderskaya, Candidate of Technical Sciences.

PURPOSE: This collection of articles is intended for workers in scientific research institutes, metal and machine works, for teaching personnel, and for students attending schools of higher education.

Card 1/6

COVERAGE: This is the second volume in a series of works on nonferrous and light-metal alloys prepared by the Institut metallurgii imeni A.A. Baykova AN SSSR (Institute of Metallurgy imeni A.A. Baykov of the Academy of Sciences USSR), and the Moskovskiy institut tsvetnykh metallov i zolota imeni M.I. Kalinina (Moscow Institute of Nonferrous Metals and Gold imeni M.I. Kalinin). The problems discussed concern the casting and physical metallurgy of nonferrous alloys. The effect of alloying and deformation on the properties of various alloys, and the problems connected with the study of the casting properties and with the plotting of phase diagrams for nonferrous alloys are discussed. No personalities are mentioned. References accompany most of the articles.

TABLE OF CONTENTS:

AVAILABLE: Library of Congress

Card 6/6

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83679

S/135/60/000/010/001/015
A006/A001

1.2300 only 2208

AUTHORS: Bochvar, A. A., Academician, AS USSR, Rykalin, N. N., Corresponding Member of AS USSR, Prokhorov, N. N., Professor, Doctor of Technical Sciences, Novikov, I. I., Candidate of Technical Sciences, Movchan, B. A., Candidate of Technical Sciences

TITLE: On the Problem of "Hot" (Crystallization) Cracks

PERIODICAL: Svarochnoye proizvodstvo, 1960, No. 10, pp. 3-4

TEXT: Information is given on results of investigations made by various authors on the technological strength of metal against hot crack formation. The following basic points in the problem of crystallization cracks are stated:
1. In analyzing the technological strength, two main peculiarities of the conditions in which this strength manifests itself during welding and casting processes must be taken into account: a) the technological strength appears during the cooling of the work when phase transformations in the metal and structural changes take place, b) the technological strength manifests itself under conditions of mutually equilibrated stresses, i. e. when stresses in the zones of local changes in the specific volume of the cooling metal are balanced

Card 1/3

On the Problem of "Hot" (Crystallization) Cracks

by stresses arising in the adjacent zones. 2. Crystallization cracks arise in the crystallization range of the metal and may develop in the solid state during cooling. A sharply pronounced drop of ductility of the alloys, named the temperature range of brittleness, is observed in the "effective" crystallization range. The basic mechanism of plastic deformation in the liquid-solid state consists in the mutual displacement of crystallites. The upper limit of the "effective" crystallization range is the temperature of interlacing and coalescence of the dendrites; its lower limit is the temperature range of brittleness. When passing through this range, the deformation mechanism changes abruptly and plastic deformation of the crystallites develops intensively together with intercrystallite displacement. 3. The theory of the technological strength in welding and casting must be based on the comparison of processes of deformation and changes in ductility. The notion that the alloys are not ductile in solid-liquid state is not correct. The alloy being in solid-liquid state has, within the temperature range of brittleness, a ductility which is characterized by small values of relative elongation. It was experimentally established that the relative elongation of the alloy in the "effective" crystallization range was commensurable with the deformation in this zone. It is precisely the ductility of alloys in solid-liquid state that ensures the technological strength

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A006/A001

On the Problem of "Hot" (Crystallization) Cracks

in welding and casting, and data on the ductility of the alloys in this state permit the evaluation of their technological strength. 4. The technological strength reserve in casting or welding depends on the correlation between the temperature range of brittleness, ductility in this range, and the intensity of elastic-plastic deformation increasing with dropping temperature. All these three values must be considered when evaluating the strength reserve. 5. Changes in crack sensitivity can be determined by one of the characteristics if the two others remain constant. 6. Cracks in casting may be filled up by hydrostatic pressure and capillary forces. 7. Factors determining the temperature range of brittleness ductility and the deformation rate are enumerated.

Card 3/3

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S/128/60/000/010/003/003
A133/A133

AUTHORS: Bochvar, A. A., Rykalin, N. N., Prokhorov, N. N., Novikov, I. I., Movchan, V. A.

TITLE: On the problem of hot (crystallization) cracks during casting and welding

PERIODICAL: Liteynoye proizvodstvo, no 10, 1960, 47

TEXT: Based on the mass of experimental material which has been accumulated hitherto, the authors present some generalized survey on the problem of hot cracks originating during casting and welding. They point out that, when the technological strength is analyzed, two peculiarities have to be taken into account: a) the technological strength develops during the cooling process, b) the technological strength develops under conditions of mutually balanced stresses. They deny the possibilities of experimentally determining the elastic and plastic deformation of the metal during welding or casting by measuring the component being cast or welded. Then the authors emphasize that hot cracks originate during the

Card 1/4

On the problem of ...

metal crystallization interval and can develop during the metal cooling in the solid state. In the "effective" crystallization interval a sharp dip of the alloy plasticity can be observed, which the authors call temperature interval of brittleness. The upper boundary of the "effective" crystallization interval is the temperature at which dendrites interlace and intergrow in the crystalline skeleton. The lower boundary of the "effective" crystallization interval is the temperature of the actual solidus. At this point the mechanism of metal deformation changes abruptly: the plastic deformation of the crystallites themselves intensively develops together with intercrystalline displacements. The authors point out that the idea of alloys in the solid-liquid state not possessing plasticity is unfounded. This would lead to the conclusion that hot cracks are inevitable during welding and casting, which is not the case. Next the authors state that the technological stength reserve of castings and welds depend on the interrelation of three characteristic features: temperature interval of brittleness, plasticity in this interval and the intensity of

On the problem of ...

growth of elastic-plastic deformation as far as the temperature decreases, i. e. the deformation rate. It is maintained that the technological strength reserve can be quantitatively rated neither by the magnitude of the temperature interval of brittleness, nor by the magnitude of relative elongation in this interval, nor by the deformation rate, each taken separately. Thus the direction of variation of hot-shortness can in the first approximation only be determined by the variation of one of the three above-mentioned factors if the two others remain unchanged. Cracks originating in castings can be filled with molten metal under the effect of hydrostatic pressure and capillary forces. The magnitude of the temperature interval of brittleness is determined by the chemical composition of the alloy, the content of additives located along the grain boundaries, dendritic liquation, dimensions and shape of crystallites, rate of cooling and deformation. The plasticity of the alloy in the"effective" crystallization interval is determined by the following factors: ratio of solid to liquid phase volume, dimensions and shape of crystallites and kind of distribution of the

S/128/60/000/010/003/003
A133/A133

On the problem of ...

liquid phase, chemical and structural micro-nonhomogeneity, rate of deformation. The rate of deformation is determined by the thermal coefficient of linear contraction, the rigidity of the welding joint or yielding of the linear shape, kind of temperature distribution determining the degree of deformation concentration and also by the deformation of the parts being cast or welded. Length and width of cracks cannot serve as measure of resistance of the metal against the formation of hot cracks. The authors conclude by stating that the difference between the minimum relative elongation in the "effective" crystallization interval and the magnitude of free temperature deformation (linear shrinkage) at the temperature of this minimum can be used as quantitative characteristic of the resistance of metal to the origination of hot cracks.

Card 4/4

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77238
SOV/89-8-2-3/30

AUTHORS: Bochvar, A. A., Sergeyev, G. Ya., Davydov, V. A.

TITLE: Deformations of Uranium Subjected Simultaneously to Thermal Cycles and Tensile Stresses

PERIODICAL: Atomnaya energiya, 1960, Vol 8, Nr 2, pp 112-116 (USSR)

ABSTRACT: Method of Investigation. Figure 1 represents the special device operating under vacuum of the order of 10^{-5} mm Hg. Temperature control was automatic and the residual deformation of uranium was studied by measuring the size of the samples after (1) the cyclic thermal treatment without outside stresses (a freely hanging specimen of small weight); (2) creep investigation at the maximum cycle temperature for intervals of time equal to the cycling time in the next part; and (3) cycling thermal treatment with tensile stresses equal to those in part (2). Sample temperatures were measured at three points by means of thermocouple velded to it. The temperature drop across the sample

Card 1/8

was between 5 and 10° C. Under investigation were samples of granular sheet uranium (rolled in the α -phase region), and uranium annealed in the γ -phase region (randomly oriented crystals). All samples were flat, of an overall length of 100 mm (working length, 40 mm; width, 8 mm). Thickness of the samples A, B, C was 2.3, 2.2, and 3.2 mm respectively. Samples Cut Across the Direction of Roll. Tables 1 and 2 summarize all the results obtained from the cross-cut samples. Samples Cut Along the Direction of Roll. Results are summarized in Table 3. Samples With Random Orientations of Crystallites. (See Table 4.) One sees in all cases that in the case of simultaneous influence of cyclic thermal treatment and tensile stress there is a considerable increase of the length variation of the samples compared to the creep caused by simple tension. This happens even in cases when the stress effect and that due to the thermal cycling are of opposite sign. There are 4 tables; 5 figures; and 4 references, 1 Soviet, 2 U.K., 1 U.S. The U.K. and U.S. references are: A. McIntosh, T. Heal, Paper Nr 49 Submitted by Great Britain to the Second Intern.

Deformation of Uranium Subjected Simultaneously to Thermal Cycles and Tensile Stresses

77238
SOV/89-8-2-3/30

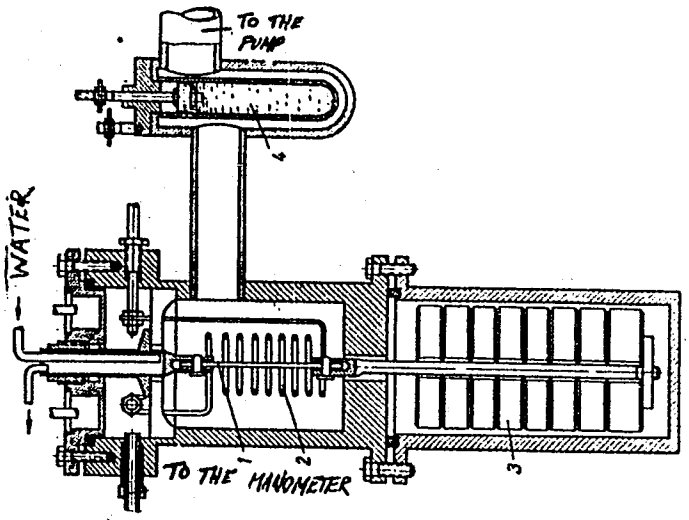

Fig. 1. Diagram of the device: (1) sample (2) molybdenum heater; (3) load; (4) liquid nitrogen trap.

Card 3/8

Table 1. Relationship between constant applied stress and residual deformation of uranium during cyclic thermal treatment and after creep tests (samples out crosswise to the direction of rolling).

TREATMENT	CONSTANT APPLIED STRESS G kg/mm²	RESIDUAL ELONGATION OF SAMPLES					
		AFTER 140 CYCLES IN THE INTERVAL 140–550° C*			AFTER CREEP TESTS AT 530° C (WITHOUT THERMAL CYCLES)**		
		Nr of SAMPLE	Δl, mm	δ, %	Nr of SAMPLE	Δl, mm	δ, %
SAMPLE B, ROLLED AT 300° C WITH 60 % REDUCTION	0	54	−0.32	−0.8	—	—	—
	0.8	52	+0.67	+1.67	53	+0.1	+0.25
SAMPLE A***, ROLLED AT 300° C WITH 70% REDUCTION	0.	34	−0.5	−1.25	—	—	—
	1.25	36	+1.9	+4.8	37	+0.44	+1.1
SAME, WITH ANNEALING AT 575° FOR 2 HR	0.	41	−0.65	−1.65	—	—	—
	1.25	40	+2.6	+6.5	39	+0.08	+0.2

* HEATING TIME 1.5 MIN, COOLING TIME 4 MIN

** TESTS CONTINUED 3 HR; THIS WAS THE TIME DURING WHICH SAMPLES STAYED AT TEMPERATURES HIGHER THAN 350°C WHILE SUBJECTED TO 200 THERMAL CYCLES.

*** RESIDUAL ELONGATION OF SAMPLES A IS SPECIFIED AFTER 200 CYCLES.

Card 4/8

Table 2. Relationship between constant applied stress and residual deformation of rolled uranium during cyclic thermal treatment and after creep tests (samples cut crosswise to the direction of rolling).

TREATMENT	CONSTANT APPLIED STRESS G, kg/mm²	RESIDUAL ELONGATION OF SAMPLES			
		AFTER 140 CYCLES*		AFTER CREEP TESTS AT 550°C (WITHOUT THERMAL CYCLES)**	
		Δl, mm	δ %	Δl, mm	δ %
MELT R, ROLLED AT 500°C WITH 85% REDUCTION	0	− 0,93	− 2,32	—	—
	1	+ 0,82	+ 2,05	+0,5	+1,2
	2	+ 3,77	+ 9,42	+1,1	+2,7
	3	+ 5,32	+13,3	—	—

* HEATING TIME, 1.5 MIN; COOLING TIME, 4.5 MIN; TIME FOR 1 CYCLE 5,5 MIN

** TESTS CONTINUED FOR 14 HR

Card 5/8

Table 3. Relationship between the constant applied stress and the residual deformation of the rolled uranium during cyclic thermal treatment and after creep tests (samples cut along the direction of rolling).

TREATMENT	CONSTANT APPLIED STRESS σ, kg/mm²	RESIDUAL ELONGATION OF SAMPLES			
		AFTER 140 CYCLES IN THE INTERVAL 180-550°C		AFTER CREEP TESTS AT 550°C (WITHOUT THERMAL CYCLES)**	
		Δl, mm	δ, %	Δl, mm	δ, %
MELT B, ROLLED AT 300°C WITH 60% REDUCTION	0	0.33	0.8	—	—
	0.8	0.84	2.1	0.1	0.25
	2.0	3.44	8.6	0.72	1.8
	3.0	6.31	15.8	1.2	3.0
	4.0	25.52	63.8	3.42	8.4

* HEATING TIME 1.5 MIN, COOLING TIME 4 MIN

** TESTS CONTINUED 14 HR

Card 6/8

Table 4. Relationship between constant applied stress and residual deformation during cyclic thermal treatment and after creep tests of uranium annealed in the γ-phase

TREATMENT	CONSTANT APPLIED STRESS σ, kg/mm^2	RESIDUAL ELONGATION OF SAMPLES			
		AFTER 100 CYCLES IN THE INTERVAL 180-550°C*		AFTER CREEP TESTS AT 550° C (WITHOUT THERMAL CYCLES)**	
		Δl, mm	δ, %	Δl, mm	δ, %
SAMPLE C ROLLED AT 300° C WITH 60% REDUCTION AND ANNEALED AT 850° C FOR 30 MIN	0	+ 0.17	+ 0.4	—	—
	1	+ 0.67	+ 1.6	+0.1	+0.25
	2	+ 1.22	+ 3.05	+0.12	+0.30
	2.7	+ 2.51	+ 6.27	+0.36	+0.9

* HEATING TIME 3 MIN; COOLING TIME 4 MIN; TIME OF THE CYCLE 7 MIN

Card 7/8 ** TESTS CONTINUED 14 HR

Deformation of Uranium Subjected Simultaneously to Thermal Cycles and Tensile Stresses

77238
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Conf. for Peaceful Use of Atomic Energy (Geneva, 1958); R. Nichols, Nucl. Engng, 2, Nr 18, 355 (1957); A. Roberts, A. Cotrell, Philos. Mag., 1, 711 (1956).

SUBMITTED: October 8, 1959

Card 8/8

1.1710

30899
S/180/61/000/005/009/018
E073/E335

AUTHORS: Bochvar, A.A., Korol'kov, G.A. and Novikov, I.I. (Moscow)

TITLE: Influence of cyclic temperature changes on the impact strength and structure of stainless chromium-nickel steel

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo. no. 5, 1961, pp. 73 - 74

TEXT: The authors have investigated the influence of thermal cycling (up to 775 cycles) in the temperature range 700 - 20 °C (water) and 650 - 20 °C (water) on the impact strength and the structure of the steel 1Kh18N9T (1Kh18N9T). The steel contained 0.09% C, 18.7% Cr and 8.9% Ni. Specimens 10 x 10 x 55 mm were subjected to thermal cycling on automatically operating equipment. Two specimens were placed vertically, one on top of the other, in a nichrome boat which was suspended in a tubular furnace; over a length of 200 mm the temperature gradient did not exceed 3 - 4 °C. The duration

Card 1/4

Influence of ....

of the cycle (heating 8 min, quenching about 1.5 min) was chosen to ensure full heating of the specimens in the furnace and their complete cooling in water. Thermal cycling between 650 and 20 °C led to a drop in the impact strength from the initial value of 30 kgm/cm^2 to 22 kgm/cm^2 after about 750 cycles; the decrease is more pronounced during the first 100 thermal cycles than during the subsequent thermal cycling. The thermal cycling did not lead to any appreciable increase in the length of the specimens. Data on the drop in impact strength as a result of long-run holding at 650 and 700 °C are quoted from the work of H.W. Kirkly and J.I. Morley (Ref. 5 - Iron and Steel Inst., Spec. rep., 1959, no. 64). The authors of this paper carried out experiments with the aim of comparing the effect of isothermal annealing with that of thermal cycling on the impact strength. In the initial state the specimens had impact-strength values of 23.3 and 25.6 kgm/cm^2. After 540 thermal cycles (700 - 20 °C - water) the impact strength dropped to 7.0 and 10.4 kgm/cm^2.

Card 2/4

respectively; after isothermal soaking at 700 °C for 100 hours the impact-strength values were 18.8 and 19.6 kgm/cm^2, respectively. During the thermal cycling the total resistance of the specimens in the furnace was about 72 hours. Microscopic analysis did not reveal any appreciable structural changes caused by the thermal cycling. Magnetic analysis showed that the thermal cycling increased the quantity of the ferromagnetic α-phase considerably more strongly than isothermal annealing. The pulling-force values determined on magnetic scales in the initial state after soaking at 700 °C for 100 hours and after 540 thermal cycles (700 - 20 °C) were in the following ratios: 1; 1.3; 1.9. This effect was still more pronounced when the core of the specimens was drilled out. The results indicate that the formation of the α-phase under the effect of thermal cycling is most intensive in the surface layers of the specimen. In these, short microcracks were detected which, with increasing number of cycles, developed into macroscopic cracks. Acknowledgments are expressed to A.A. Ivanov for carrying out magnetic tests for investigations.

30899
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Influence of ....

There are 1 figure, 1 table and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc (quoted in the text).

SUBMITTED: October 22, 1960

Card 4/4

34514
S/659/61/007/000/001/044
D217/D303

21.2110
18.8200 also 2408

AUTHORS: Bochvar, A.A., Sergeyev, G.Ya., Davydov, V.A., and Zhul'kova, A.A.

TITLE: Influence of cyclic heat treatment under a constantly applied load on the dimensional stability of metals and alloys

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam, v. 7, 1961, 3 - 10

TEXT: Flat specimens of identical shape, and overall length 100 mm (length of working portion 40 mm, width 8 mm, thickness 2 mm), made from uranium, aluminum, zinc and from copper-zinc alloys of different compositions, were used for the investigation. The uranium specimens were tested without protection against oxidation, heating being carried out in air and quenching in water. The specimens were subjected to cyclic heat treatment in the temperature ranges 180 - 550°C and 490 - 720°C for uranium 20 - 400°C for aluminum, 20 - 300 °C for zinc and 20 - 600°C for copper-zinc alloys. The temperatures

Card 1/4

Influence of cyclic heat ...

of specimens were controlled at these points by means of thermocouples welded onto the specimens. The magnitude of the residual deformation of the specimens was determined (1) after cyclic heat treatment without application of external load; (2) after cyclic heat treatment with application of a tensile load during the heat treatment cycle; (3) after creep tests at a temperature equal to the upper temperature of the cycle. The duration of the latter tests was that of the full period of the heat treatment cycle, multiplied by the number of cycles (the load during cyclic thermal treatment under load and in the creep tests being identical). Texturized uranium rolled in the α-phase region and untexturized uranium annealed in the γ-phase region and quenched from the β-phase region, were tested. Specimens of texturized uranium were cut along the direction of rolling and at right angles to it. It was found that as the result of applying a small tensile load to uranium, aluminum, zinc, α and β brass during cyclic heat treatment, a considerable residual deformation developed; this exceeded the total deformation due to creep and cyclic heat treatment without application of load, by a considerable extent. Cyclic thermal treatment of transfer specimens

Card 2/4

of texturized uranium sheet in the α-phase temperature range, and also of β-brass, in the absence of tensile load causes a shortening of the specimens, and on application of a small external tensile load it leads to a considerable elongation in the direction of the acting force. As a result of cyclic thermal treatment of uranium at a constant load, the residual plastic deformation on passing through the $\alpha \rightleftharpoons \beta$ phase transformation point is greater than deformation as a result of cyclic thermal treatment within the α-region. In α + β brass the residual deformation brought about as a result of testing for creep only, considerably exceeds the deformation under the influence of cyclic thermal treatment with a constantly applied load. The change in dimensions of the specimens is in the direction of the action of the externally applied load. The considerable change in the magnitude of residual deformation and even in the sign of deformation as a result of the action of small stresses, applied to the specimen during cyclic thermal treatment, is due, in the authors' view, to the fact that on applying a constant tensile load to a specimen submitted to cyclic thermal treatment, the initial stage of the first period of creep, in which the material exhibits a higher rate of deformation, is repeated; this is also promoted by

Card 3/4

Influence of cyclic heat ...

the great mobility of atoms at points in the thermal cycle during which temperature gradients and stresses exist, and also on passing through the $\alpha \rightleftharpoons \beta$ phase transformation point. There are 12 figures, and 7 references: 4 Soviet-bloc and 3 non-Soviet-bloc. The references to the English-language publications read as follows: A.H. Cottrell, Met. Rev., 1, 1956; A.C. Roberts, and A.H. Cottrell, Phil. Mag., 1, 18, 1956; R.W. Nichols, Nuclear eng., 2, 18, 1957.

X

Card 4/4

BOCHVAR, A.A.; BELYAYEV, A.I.; PAVLOV, I.M.; PLAKSIN, I.N.; CHIZHIKOV, D.M.; PERLIN, I.L.

Petr Stepanovich Istomin; on his 80th birthday. Izv. vys. ucheb. zav.; tsvet. met. 4 no.4:161-163 '61. (MIRA 14:8)
(Istomin, Petr Stepanovich, 1881-)

TUMANOV, A.T., zasluzhennyy deyatel' nauki i tekhniki RSFSR;
DAVIDENKOV, V.V., akademik; SERENSEN, S.V., akademik;
KURDYUMOV, G.V., akademik; BOCHVAR, A.A., akademik;
KISHKIN, S.T.; ZAYMOVSKIY, A.S.; SHCHAPOV, N.P., prof.;
KUDRYAVTSEV, I.V., prof.; VITMAN, F.F., prof.; KISHKINA,
S.I., prof.

IAkov Borisovich Fridman; on the fiftieth anniversary of his birth. Zav.lab. 27 no.7:919-920 '61. (MIRA 14:7)

1. Akademiya nauk USSR (for Davidenkov, Serensen). 2. Chleny-korrespondenty Akademii nauk SSSR (for Kishkin, Zaymovskiy).
(Fridman, IAkov Borisovich, 1911-)

45225

S/806/62/000/003/001/018

AUTHORS: Bochvar, A.A., Sviderskaya, Z.A., Lazarev, G.P.

TITLE: Effect of the purity of the parent metal on the heat-resistance of an alloy.

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniye splavov tsvetnykh metallov. no. 3. 1962, 5-11.

TEXT: Earlier investigations of the senior author and others (Akad. n. SSSR, Otd. tekhn. nauk, no. 2, 1954, 42-45 and 46-51) have shown that the heat-resistance of an alloy can be either enhanced or lowered by identical impurities present in different proportion, depending on whether the solidus T is raised or lowered by the predominant impurity. Matters become yet more complicated when the impurities form readily fusible components in the alloy and reduce the solidus T sharply, whereupon some of the heat-resistance (HR) characteristics, such as the long-term hardness, on which the properties of thin boundary layers have little effect, may not be altered, whereas the fundamental HR characteristics (long-term stress-rupture limit and fracture time at a given tensile stress) may be reduced to a mere fraction. The present paper describes tests intended to clarify the effect of impurities on the HR of the parent metal, in which two series of Al-Cu alloys were prepared: Series I based on 99.99% pure Al and Series II based on ordinary technical

Card 1/3

Al (99.7% Al, 0.11% Fe, 0.13% Si). Two sets of HR tests were made: (1) Long-term hardness (LTH) was determined by 1-hr loading of a 10-mm diam steel ball under a 100-kg load at 300°C; (2) stress-rupture strength (SRS) was determined by the failure time under a 1.5-kg/mm^2 stress at 300°. The tests were preceded by 100-hr soaking at test T. In both tests the technical-Al alloy was found to be significantly stronger than the pure-Al alloy. The effects of an introduction of Cu were overshadowed by those of the Fe and Si, since the latter affect the structure of the alloy and the recrystallization processes therein. Metallographic observations are reported and depicted photographically. Specimens cast onto a cold plate exhibited a dendritic structure which became more sharply defined as the amount of impurities increased. Also, the purer Al (99.99% and 99.999%) develops two mutually intersecting networks of crystallite boundaries, whereas the 99.7% Al manifests only a single such network. Although the cooling of the cast metal proceeded very quickly, the recrystallization occurred extremely fast (of the order of 1 mm/sec) in the purest Al, but appeared to be effectively inhibited by even a 0.3% total of impurities. It was thus postulated that the changes in heat-resistance were somehow related to the recrystallization process. Tests with casting done on a plate heated to 300°C did not effect any noticeable development of the recrystallization process in the 99.7% Al, but accelerated it appreciably in the 99.999% Al. Casting of two Al-Cu alloys on a cold plate produced practically identical single-network structures, but

casting on a plate heated to 300°C resulted in a single network in the alloy based on 99.7% Al, but two intersecting networks in the alloy based on 99.99% Al. Conclusion: 0.3% Fe-Si impurities improve the heat-resistance of technical Al more than 4% Cu in high-purity Al. It could be reasoned that, since diffusion processes during recrystallization and creep develop especially intensively along the boundaries of the subdivisions of a structure, an increase in the number of grains and subgrains (total boundary surface) would increase the creep (decrease heat-resistance). Actually, however, the comminution of the dendritic structure accompanying an increase in impurities results in the opposite effect. Thus, evidently, the creep-stimulating effect of the branching of the dendrites in a more impure alloy is more than matched by some other, creep-inhibiting, change. It is hypothesized that this change consists in a concentration of the impurity atoms or alloying-substance atoms near the boundaries of the dendritic and subdendritic subdivisions which alters the composition structure, and properties of the near-boundary regions. Further reasonings and amplifications on this basic hypothesis are adduced. There are 4 figures, 2 tables, and 4 references (the 2 Russian-language Soviet references adduced in Card 1/3 of the Abstract; 1 German: Vogel, R., Zeitschr. f. anorg. und allgem. Chemie, v.126, 1923, 1; and 1 French: Montariol, Publ. Scient. Techn. du Ministère de l'Air, no. 344, 1958).

ASSOCIATION: None given.

BOCHVAR, A.A.(Moskva); GLAGOLEVA, N.N.(Moskva); NOVIKOV, I.I.(Moskva)

Relation between the distribution of etch figures and slip lines in polycrystalline aluminum. Izv. AN SSSRL.Otd.tekh.nauk. Met. i topl. no.5:15-16 S-O '62. (MIRA 15:10)
(Aluminum crystals) (Dislocations in metals)

BOCHVAR, A. A.; KUZNETSOVA, V. G.

"Investigation of self-diffusion processes in uranium and its alloys."

report submitted for 3rd Intl Conf, Peaceful Uses of Atomic Energy, Geneva, 31 Aug-9 Sep 64.

BOCHVAR, A. A.; KUZNETSOVA, V. G.; et al

"Investigation of Self-Diffusion Processes in Uranium and its Alloys."

report submitted for 2nd Intl Conf, Peaceful Uses of Atomic Energy, Geneva, 31 Aug-9 Sep 64.

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Twinning during the deformation of metals. Izv. AN SSSR. Met. i gor. delo no.1:92-94 Ja-F '64. (MIRA 17:4)

DRITS, M.Ye., doktor tekhn. nauk, otv. red.; BOCHVAR, A.A., akademik, red.; BELOV, A.F., doktor tekhn. nauk, red.; DOBATKIN, V.I., doktor tekhn. nauk, red.; MAL'TSEV, M.V., doktor tekhn. nauk, red.; FRIDLYANDER, I.N., doktor tekhn. nauk, red.; SVIDERSKAYA, Z.A., kand. tekhn. nauk, red.; YELAGIN, V.I., kand. tekhn. nauk, red.; BARBANEL', R.I., kand. tekhn. nauk, red.; SHAROV, N.V., kand. tekhn. nauk, red.; KADANER, E.S., kand. tekhn.nauk, red.; TROKHOVA, V.F., red.; CHERNOV, A.N., red.

[Metallography of light alloys] Metallovedenie legkikh splavov. Moskva, Nauka, 1965. 226 p. (MIRA 18:10)

1. Moscow. Institut metallurgii.

L 3466-66 EWT(m)/EPF(n)-2/T/EWP(t)/EWP(b)/EWA(c) IJP(c) ES/JD/JG/AW

ACCESSION NR: AP5016929 UR/0089/65/018/006/0601/0608
621.039.542.32

AUTHORS: Bochvar, A. A.; Kuznetsova, V. G.; Sergeyev, V. S.; Butra, F. P. 47 27 B

TITLE: Self diffusion in the alpha and beta phases of uranium

SOURCE: Atomnaya energiya, v. 18, no. 6, 1965, 601-608

TOPIC TAGS: metal diffusion, uranium, metal phase system, activation energy 16

ABSTRACT: This is paper no. 333 presented by the SSSR at the Third Geneva Conference in 1964. The authors investigated by an autoradiography method the dependence of the rate of self-diffusion on the crystallographic direction in the two low-temperature phases of uranium. Earlier data on the self-diffusion in these phases are contradictory. Apparatus was developed in which the self-diffusion coefficient was calculated from the rate of change of the α activity on the surface of the sample during the course of annealing, as well

Card 1/3

L 3466-66
ACCESSION NR: AP5016929

as by autoradiography of the surface of the sample. The investigations were made on single crystals, polycrystalline samples with large perfect grains, and polycrystalline samples with imperfect grains. The test procedure and the method of calculating the self-diffusion coefficients from the change of α activity and from the autoradiograms are described. The results for α-uranium are listed in Table 1 of the Enclosure. The results for β-uranium are similar to those for α-uranium, but the experimental conditions did not make it possible to establish the directions with the maximum and minimum self diffusion coefficients. The coefficient obtained for the temperature range 700 --750C from the variation of the α activity lies in the range (2--6) x 10^{-11} cm^2sec. The results demonstrate convincingly the presence of anisotropy of self-diffusion in the α and β phases of uranium. Orig. art. has: 7 figures, 4 formulas, and 1 table.

ASSOCIATION: None

SUBMITTED: 00 ENCL: 01 SUB CODE: NP, MM

NR REF SOV: 001 OTHER: 010

Card 2/3

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ACCESSION NR: AP5016929

ENCLOSURE: 01

0

Table 1. Values of the self-diffusion coefficients in different crystallgraphic directions in alpha-uranium.

Grain number	Crystallogr. direction	Self diffusion coeff. cm^2/sec
2	[010]	$\leq 10^{-14}$
8	[010]	$\leq 10^{-14}$
1	[021]	$6,3 \cdot 10^{-14}$
5	[240]	$6,4 \cdot 10^{-14}$
7	[130]	10^{-13}
6	[153]	$1,6 \cdot 10^{-13}$
4	[111]	$1,8 \cdot 10^{-13}$
3	[001]	$2,1 \cdot 10^{-13}$

Card 3/3 DP

L 3378-66 EWT(d)/EWT(m)/EWP(w)/EWP(v)/T/EWP(t)/EWP(k)/EWP(h)/EWP(b)/EWP(l)/EWA(h)/EWA(c) IJP(c) JD

ACCESSION NR: AP5017207 UR/0020/65/162/006/1277/1280

AUTHORS: Lozinskiy, M. G.; Romanov, A. N.; Bochvar, A. A.

TITLE: Concerning the mechanism of extrusion and intrusion displacement of microvolumes of alpha iron during fatigue tests under high temperature heating

SOURCE: AN SSSR. Doklady, v. 162, no. 6, 1965, 1277-1280

TOPIC TAGS: iron, mechanical fatigue, high temperature fatigue, fatigue test, crystal imperfection

ABSTRACT: The authors report some results of observations of the fine structure of crystalline samples of technical iron, subjected to fatigue tests by alternating bending in one plane, and simultaneously to radiation heating in vacuum. The apparatus used for this purpose (IMASh-10) was developed by the authors and described by them earlier (Zav. lab. no. 2, 1965). The apparatus makes it possible to carry out fatigue tests and microstructure analysis of samples heated to 1200° under different mechanical loading conditions. The tests were

Card 1/2

L 3378-66
ACCESSION NR: AP5017207

2

made on commercial iron of standard composition. Electron-microscope photographs of the tested samples show that the relatively straight glide lines, on the boundary of which the extrusion and intrusion takes place, are located at distances equal to (2--6) x 10^3 crystal--lattice periods. The causes of occurrence of zones with increased displacement mobility at these intervals are not yet clear. It is deduced, however, from the existence of such an effect that during the time of the experiment the imperfections in the crystal become redistributed and move to individual glide planes. The kinetics of this effect is discussed in some detail. This report was presented by A. A. Bochvar. Orig. art. has: 4 figures

ASSOCIATION: Institut mashinovedeniya (Institute of the Science of Machines)

SUBMITTED: 19Nov64 ENCL: 00 SUB CODE: SS, MM

NR REF SOV: 007 OTHER: 003

Card 2/2 md

L 2672-66 EWT(m)/EWP(i)/EWA(d)/T/EWP(t)/EWP(z)/EWP(b)/EWA(c) MJW/JD

ACCESSION NR: AP5021888 UR/0020/65/163/006/1375/1376

AUTHORS: Bochvar, A. A. (Academician); Pshenichnov, Yu. P.

TITLE: Investigating the nature of distribution and density of etching figures in aluminum

SOURCE: AN SSSR. Doklady, v. 163, no. 6, 1965, 1375-1376, and insert facing p. 1376

TOPIC TAGS: aluminum, etched crystal, experimental method

ABSTRACT: The nature and density of etching figures in cast, deformed, and recrystallized aluminum specimens with trade mark AVOOO (99.99%) was investigated. To map the surface, a deep etching was carried out first in a 150 g/liter NaOH solution at 70° temperature and for a 30-minute duration. The specimens were then electropolished and etched on etching figures in a solution of 47% HNO_3 + 50% HCl + 3% HF. The density analysis was made on two geometrical forms: triangular, near the (111) plane, and square-shaped, near the (100) plane. The etching figure densities were tabulated and presented as a histogram. Analysis of the histograms showed that the law of etching figure distribution is the same in all cases, the number being of the same order of magnitude for the cast, deformed,

Card 1/2

L 2672-66

ACCESSION NR: AP5021888

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and recrystallized specimens. In all three types of aluminum specimens the etching density was of the order $10^5/cm^2$. Finally, the nature of these etching figures was found to remain unchanged from the cast to the recrystallized specimens. "The authors express their gratitude to L. B. Zlotin for mirror-finish rolling the aluminum specimens and to N. S. Gerchakova for her help in the experiments." Orig. art. has: 1 figure and 1 table. 44,55 44,55

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys) 44,55

SUBMITTED: 21May65 ENCL: 00 SUB CODE: MM

NO REF SOV: 000 OTHER: 001

Card 2/2

L 3081-66 EWT(m)/EWP(t)/EWP(b) JD

ACCESSION NR: AP5023997 UR/0020/65/164/002/0305/0306
539.374+539.379.4

AUTHOR: Bochvar, A. A. (Academician); Pshenichnov, Yu. P.; Chuvilina, I. N.

TITLE: On the growth of deformation twins

SOURCE: AN SSSR. Doklady, v. 164, no. 2, 1965, 305-306, and insert facing p. 306

TOPIC TAGS: twinning, bismuth, zinc, metal crystal, compressive stress

ABSTRACT: To check the hypothesis that the growth of deformation twins occurs during the load removal and reloading, the sample under load was observed directly in the course of the entire experiment. A microscope was attached to a Brinell press, which served to compress the samples at room temperature. The samples consisted of cast macrocrystalline samples of zone-refined Bi (>99.999%), commercial Bi (>98.5%), and Zn (>99.99%). It was noted that twins were formed in zone-refined Bi as soon as the maximum specified compressive load was reached (110 kg; equivalent to a stress of 1.2 kg/mm^2). Twins appeared in zone-refined Bi at loads 1.5 to 2 times smaller than in commercial Bi, and their growth rate was faster. Certain twins, formed at a given load did not show any further growth either during cyclic

Card 1/2

L 3081-66

ACCESSION NR: AP5023997 3

loading or when the load was increased; this was particularly apparent in the commercial Bi. Results of direct observations of the development of deformation twins were compared with changes in the size of twins subjected to cyclic loading with a constant maximum load. In all metals, the appearance of new twins, an increase in the size of old ones, and fusion of the twins were observed. It is concluded that under prolonged loading, the observed growth of twins does not occur when the maximum constant load is acting, but rather during periods when the stress condition changes, i.e., when the load is temporarily removed or brought back up to its previous value. Orig. art. has: 3 figures.

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys) 55

SUBMITTED: 12Jun65 ENCL: 00 SUB CODE: MM, SS

NO REF SOV: 002 OTHER: 000

Pure metal 18

Card 2/2

L 42321-66 EWT(m)/EWP(v)/T/EWP(t)/ETI/EWP(k) IJP(c) JD/HM/HW

ACC NR: AP6019771 SOURCE CODE: UR/0370/66/000/003/0146/0149

AUTHOR: Bochvar, A. A. (Moscow); Yekatova, A. S. (Moscow) 3/ B

ORG: none

TITLE: Oriented crystallization in soldered seams

SOURCE: AN SSSR. Izvestiya. Metally, no. 3, 1966, 146-149

TOPIC TAGS: metal crystallization, metal soldering

ABSTRACT: Basic materials for the soldering tests were copper, nickel, iron, and steel. The solders used were copper and a copper-silver eutectic. The soldering of the samples was done in a vacuum of 3×10^{-4} mm Hg. The samples consisted of two plates of the basic metal, lap welded. Polishing of the samples was done in a plane perpendicular to the direction of the soldered seam. Investigations showed that in the case of soldering nickel with copper, a large part of the grain boundary of the nickel was prolonged in the zone of the fused seam. Investigation of soldered iron seams showed the presence of oriented crystallization of copper on the base matel. X ray methods were used to determine the orientation of the lattice of the individual grains of gamma iron and the corresponding grains of copper. In addition to the direct X ray method,

Card 1/2 UDC: 669-179

L 42321-66

ACC NR: AP6019771 O

indirect investigations were made from a metallographic picture of the soldered seams and the propagation of the lines of slip on the polished surface of the soldered sample; this showed the presence of epitaxy in the multiphase crystallization of a copper-silver alloy in the seam. It was also established that the main phase in the crystallization of a copper-silver eutectic is the silver phase which, in spite of the considerable difference in the lattice periods (about 13%), crystallizes on the copper in the form of a monocrystalline matrix. Orig. art. has: 4 figures and 1 table.

SUB CODE: 13,11/ SUBM DATE: 17Nov65/ ORIG REF: 005/ OTH REF: 001

Card 2/2

Structure and properties of cadmium-base bearing alloys. A. M. Bochvar and V. A. Il'ckhina. *Issledovanie Splavov Tsvetnykh Metal.* (Moscow: Izdatel. Akad. Nauk S.S.S.R.) *Sbornik* 1955, No. 1, 66–70; *Referat. Zhur., Met.* 1956, No. 1902. — The structure of Cd-Ni [illegible] consists of primary crystals of the [illegible] Cd_5Ni (microhardness [illegible]) [illegible] Cd_5Ni (microhardness 28 [illegible]) [illegible] ness (2% of Cd-Ni alloys [illegible]) content from [illegible] at 0.5% [illegible] room temp. With increase [illegible] to 17 [illegible] for the alloy [illegible] above [illegible] as the temp. for an Cd-Ni [illegible] of Cd-Ni alloy [illegible] for the B-83 alloy by 75 [illegible]. The [illegible] contg. Ni up to 2% could be used in [illegible] working at high speed. [illegible]

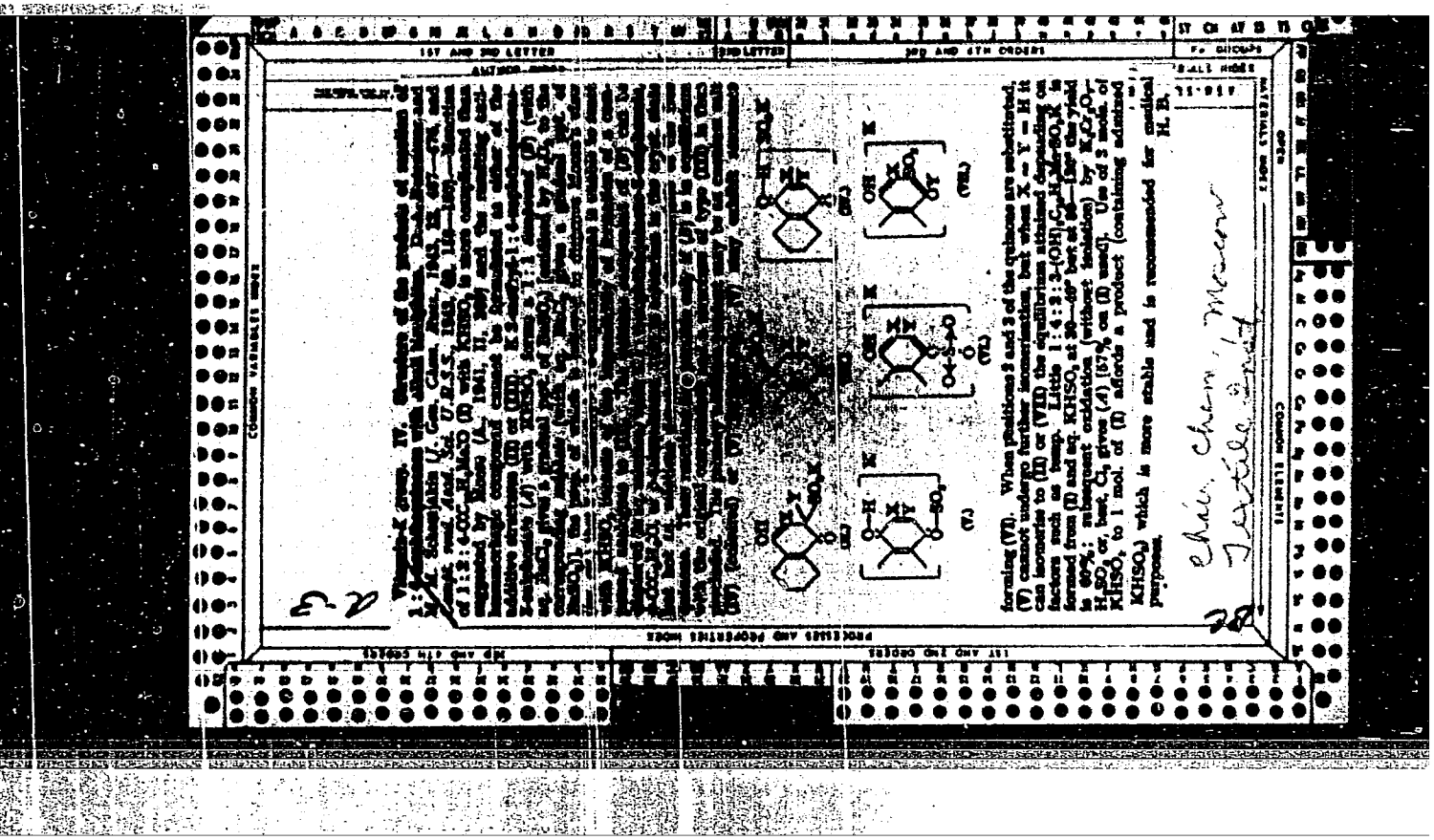
A. C. S.
Bochvar, D.A.

Chemistry + Physics

Properties of ions: IV, Ionic radii and exchange reactions of alkali halides. B. V. Nekrasov and D. A. Bochvar. *Zhur. Obshchei Khim.*, 10 [13] 1213-19 (1940); *Khim. Referat. Zhur.*, 4 [4] 11 (1941).—The process of the exchange decomposition of binary salts in solutions is discussed. As a first approximation the authors compute the coulomb forces involved. The ionic radii are taken as parameters determining the direction of the reaction. The authors show that exchange reactions in fused alkali halides give rise to salts formed from ions having the smallest radii on the one hand and salts made of ions with the largest radii on the other. V, Simplest formula for computing the energy of crystalline lattices. B. V. Nekrasov. *Zhur. Obshchei Khim.*, 10 [15] 1393-94 (1940); *Khim. Referat. Zhur.*, 4 [4] 11-12 (1941).—N. transforms the A. F. Kapustinskii equation ("Theory . . .," *Ceram. Abs.*, 15 [6] 192 (1936)) for the energy of a crystalline lattice so that it gives the energy per gram-equivalent of the substance. The equation reads:

$$U = 256 \frac{V_c + V_a}{r_c + r_a} \text{ cal./gm.-equiv.,}$$

where V_c and V_a are the valences of the cation and anion, respectively, and r_c and r_a are the respective radii according to Goldschmidt. M.Ho.

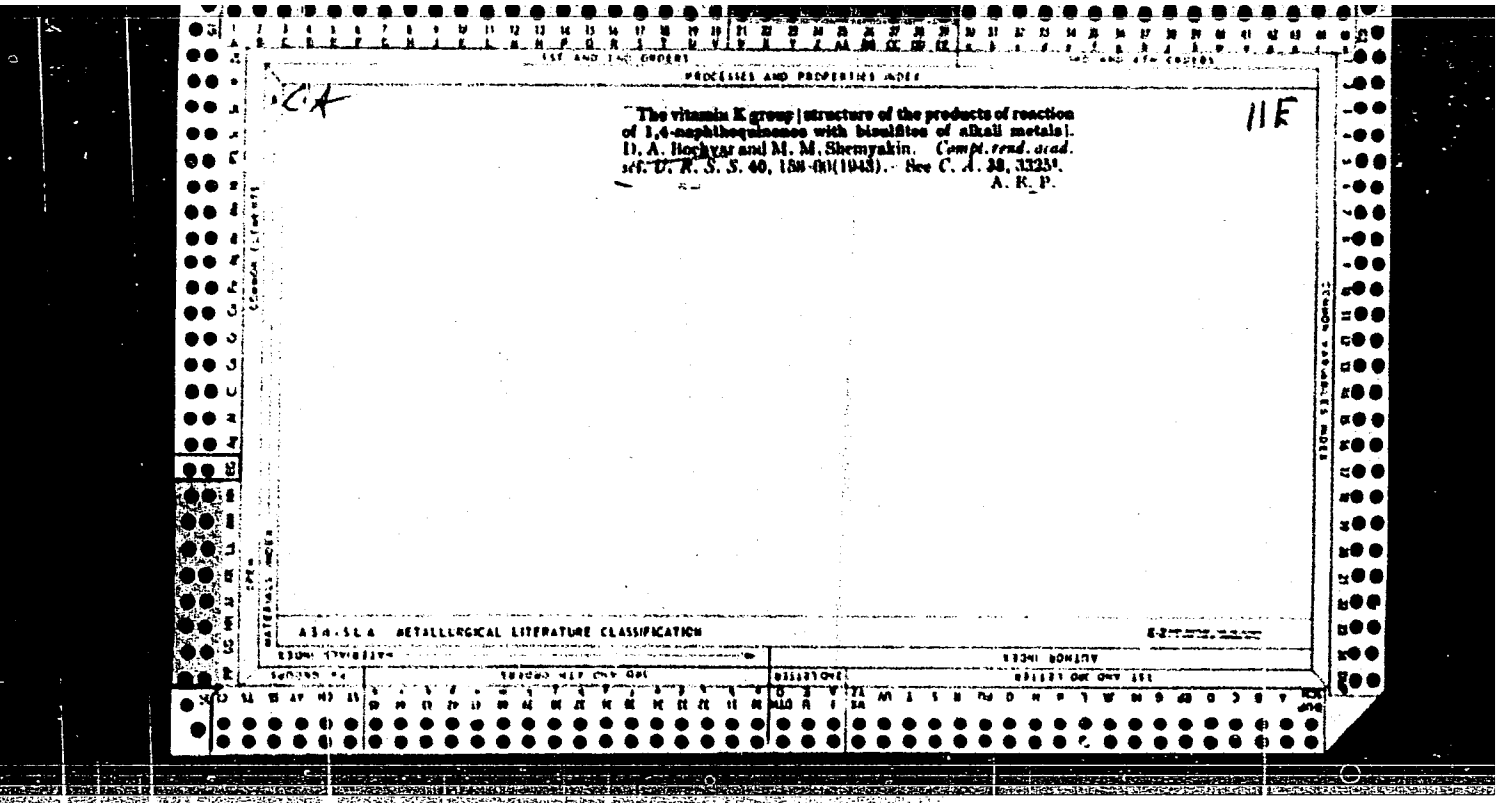


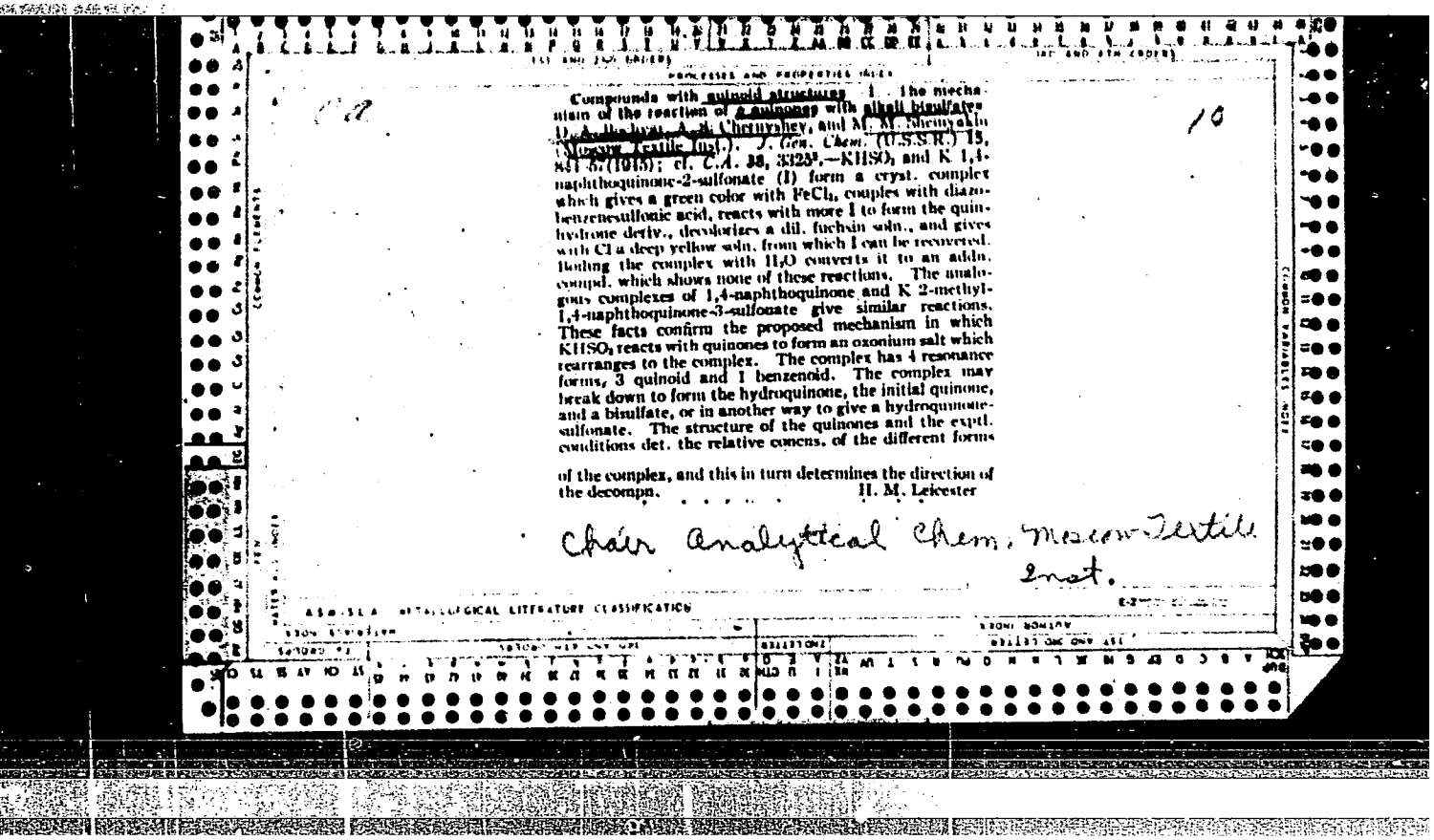
BOTCHVAR, D. A.

(p. 476)

"Investigation in the Group of Vitamin K, IV. Structure of Reaction. Products between 1, 4-Naphtoquinone and Bisulphites of Alkali Metals." Botchvar, D. A. and Sheryakin, M. M.

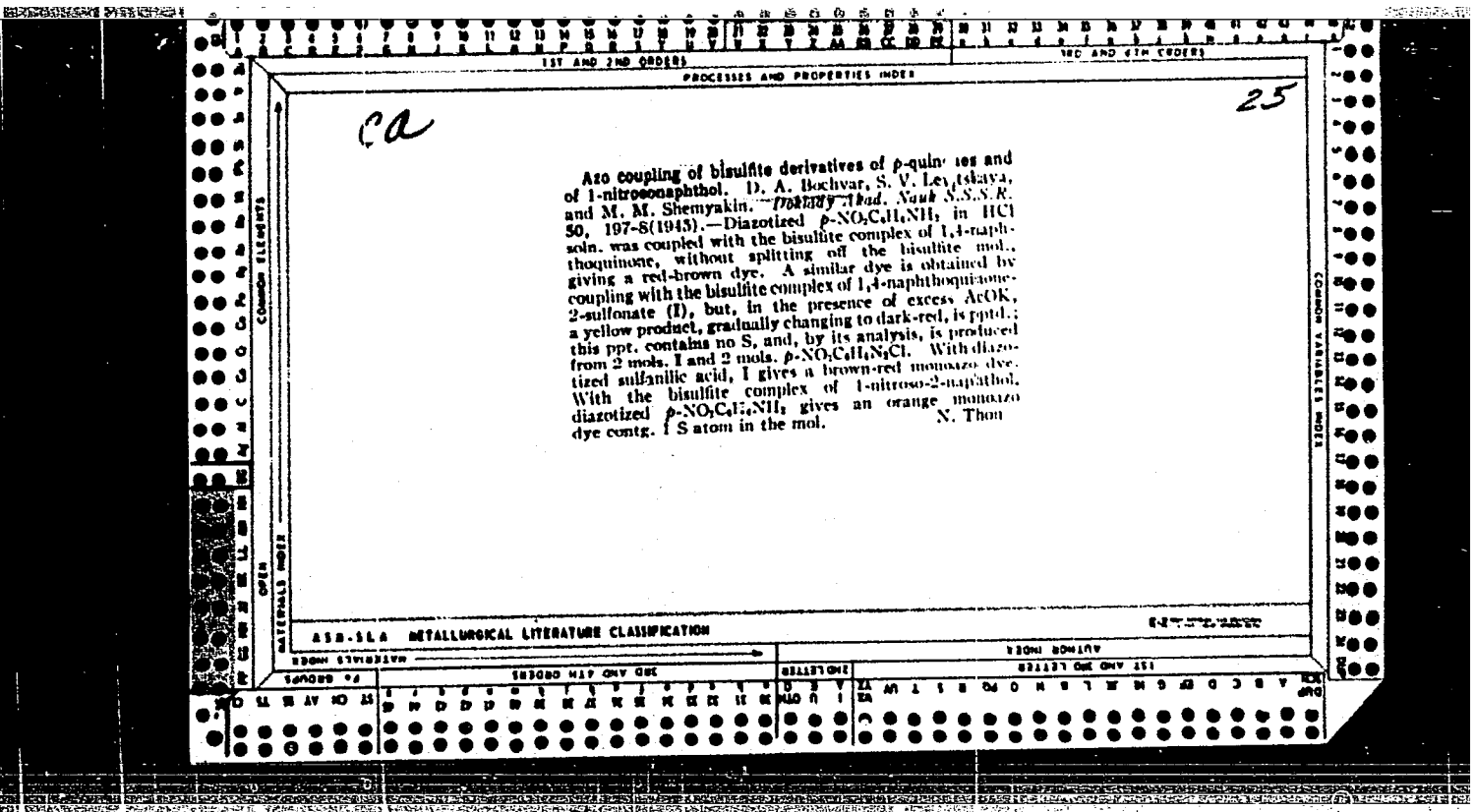
SO: Journal of General Chemistry (Zhurnal Obshchei Khimii) 1943, Volume 13, no. 6.





Compounds with quinoid structures. I. The mechanism of the reaction of p-quinones with alkali bisulfates. D. A. Shchukarev, A. N. Chernyshev, and M. M. Shemyakin (Moscow Textile Inst.). *J. Gen. Chem.* (U.S.S.R.) 15, 851-5 (1945); cf. *C.A.* 38, 3323⁹.—KHSO₃ and K 1,4-naphthoquinone-2-sulfonate (I) form a cryst. complex which gives a green color with $FeCl_3$, couples with diazobenzenesulfonic acid, reacts with more I to form the quinhydrone deriv., decolorizes a dil. fuchsin soln., and gives with Cl a deep yellow soln. from which I can be recovered. Boiling the complex with H_2O converts it to an addn. compd. which shows none of these reactions. The analogous complexes of 1,4-naphthoquinone and K 2-methyl-1,4-naphthoquinone-3-sulfonate give similar reactions. These facts confirm the proposed mechanism in which $KHSO_3$ reacts with quinones to form an oxonium salt which rearranges to the complex. The complex has 4 resonance forms, 3 quinoid and 1 benzenoid. The complex may break down to form the hydroquinone, the initial quinone, and a bisulfate, or in another way to give a hydroquinonesulfonate. The structure of the quinones and the expt. conditions det. the relative concns. of the different forms of the complex, and this in turn determines the direction of the decompn. H. M. Leicester

Chair Analytical Chem. Moscow Textile Inst.



1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

3RD AND 4TH ORDERS

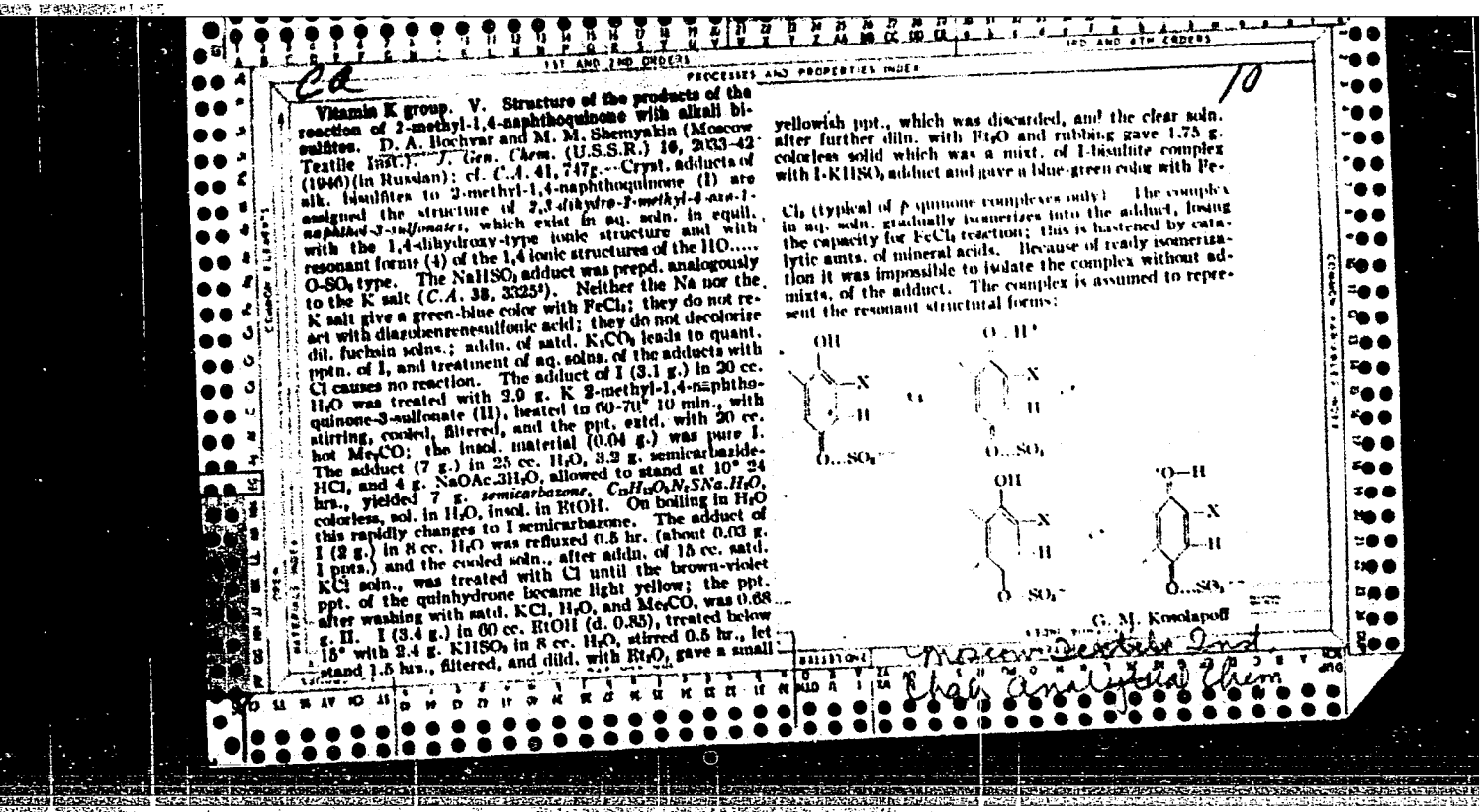
ca

25

Azo coupling of bisulfite derivatives of *p*-quinones and of 1-nitrosonaphthol. D. A. Bochvar, S. V. Levtskaya, and M. M. Shemyakin. *Doklady Akad. Nauk S.S.S.R.* 50, 197-8(1945).—Diazotized *p*-$NO_2C_6H_4NH_2$ in HCl soln. was coupled with the bisulfite complex of 1,4-naphthoquinone, without splitting off the bisulfite mol., giving a red-brown dye. A similar dye is obtained by coupling with the bisulfite complex of 1,4-naphthoquinone-2-sulfonate (I), but, in the presence of excess AcOK, a yellow product, gradually changing to dark-red, is ppted.; this ppt. contains no S, and, by its analysis, is produced from 2 mols. I and 2 mols. *p*-$NO_2C_6H_4N_2Cl$. With diazotized sulfanilic acid, I gives a brown-red monoazo dye. With the bisulfite complex of 1-nitroso-2-naphthol, diazotized *p*-$NO_2C_6H_4NH_2$ gives an orange monoazo dye contg. 1 S atom in the mol.

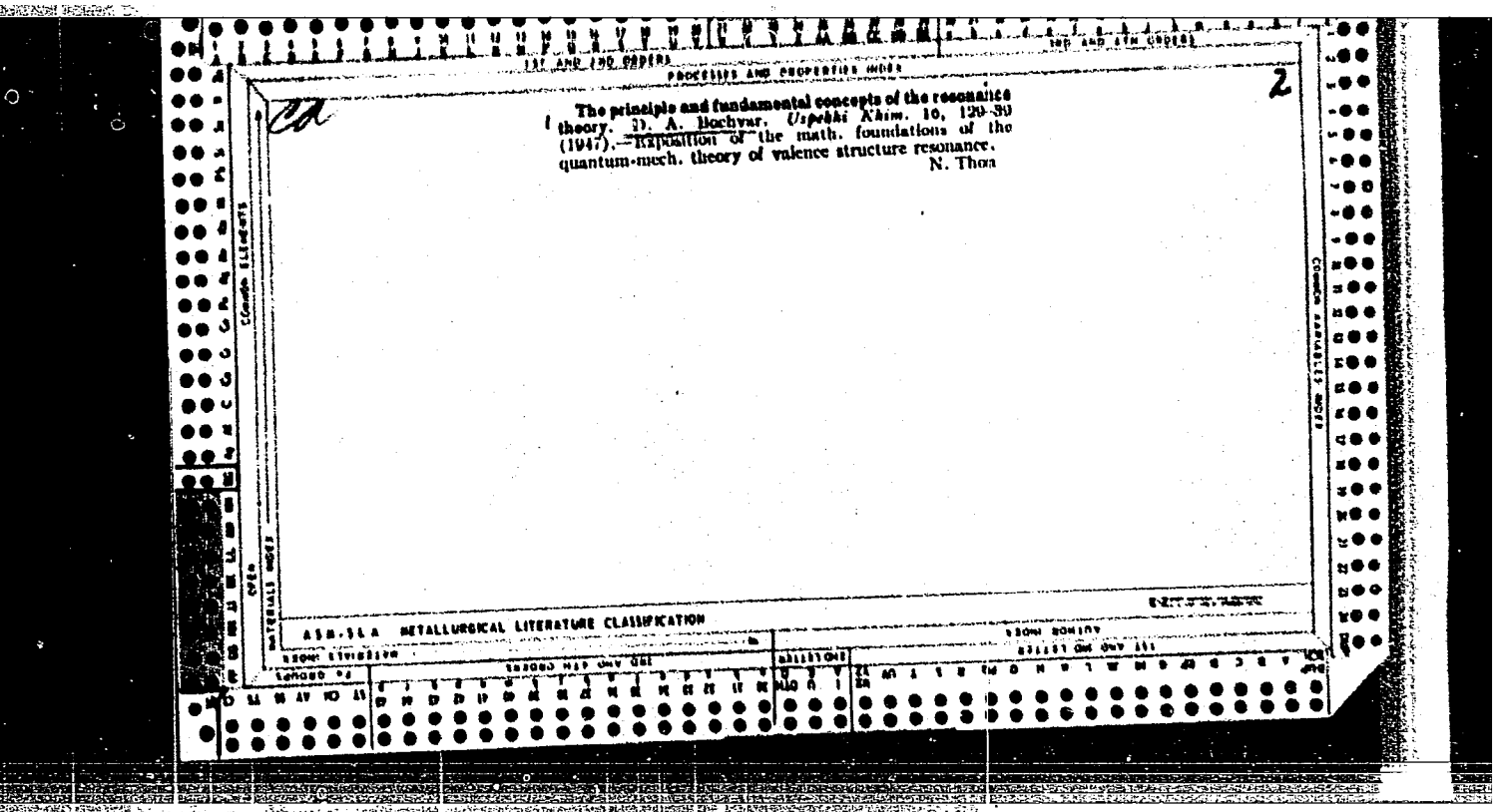
N. Thon

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

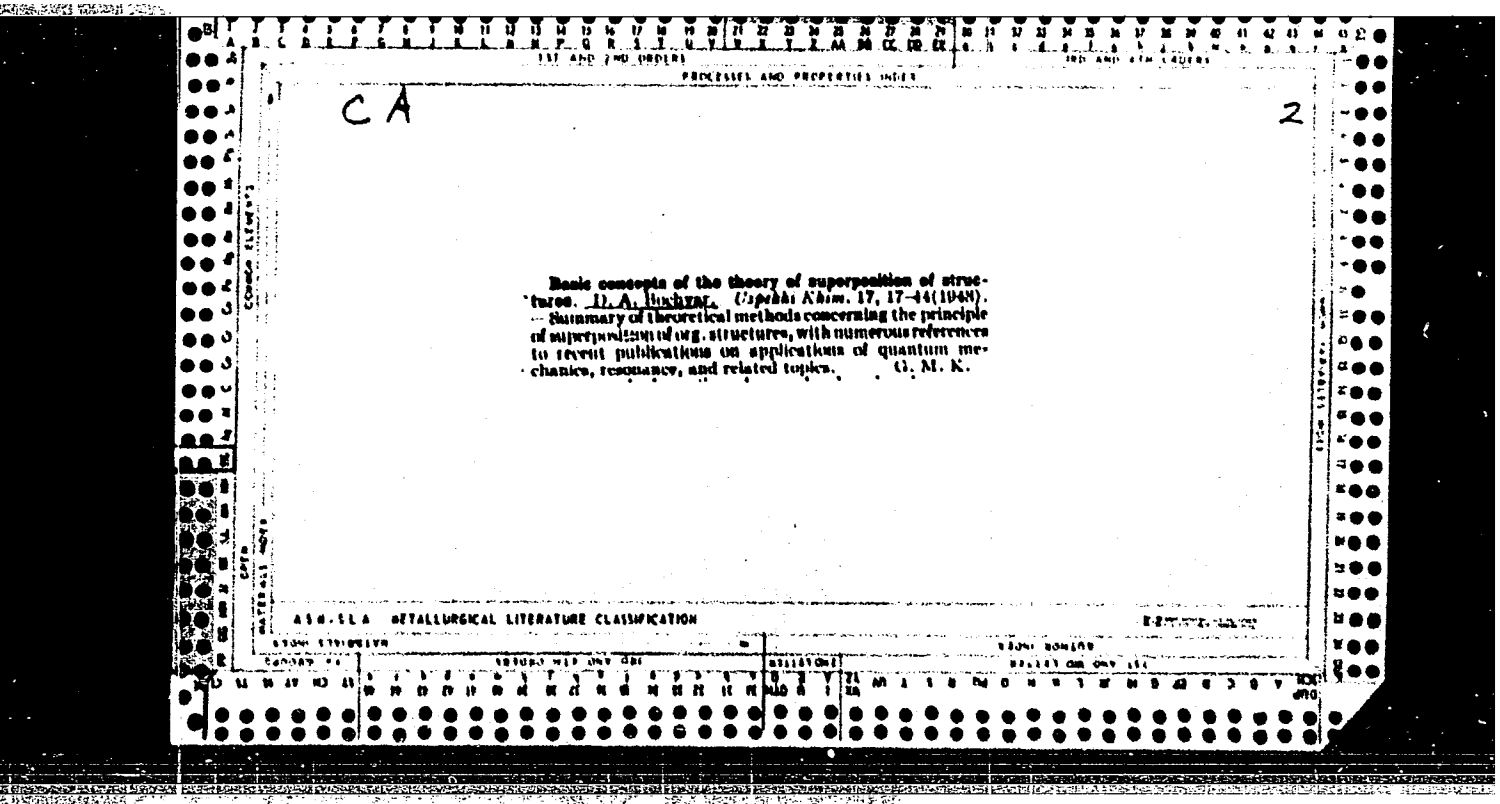


Vitamin K group. V. Structure of the products of the reaction of 2-methyl-1,4-naphthoquinone with alkali bisulfites. D. A. Hochvar and M. M. Shemyakin (Moscow Textile Inst.). *J. Gen. Chem.* (U.S.S.R.) **16**, 2033–42 (1946)(in Russian); cf. *C.A.* **41**, 747g.—Cryst. adducts of alk. bisulfites to 2-methyl-1,4-naphthoquinone (I) are assigned the structure of *2,3-dihydro-2-methyl-4-oxo-1-naphthol-2-sulfonates*, which exist in aq. soln. in equil. with the 1,4-dihydroxy-type ionic structure and with resonant forms (4) of the 1,4 ionic structures of the HO.....O-SO_3 type. The $NaHSO_3$ adduct was prepd. analogously to the K salt (*C.A.* **38**, 3325⁹). Neither the Na nor the K salt give a green-blue color with $FeCl_3$; they do not react with diazobenzenesulfonic acid; they do not decolorize dil. fuchsin solns.; addn. of satd. K_2CO_3 leads to quant. pptn. of I, and treatment of aq. solns. of the adducts with Cl causes no reaction. The adduct of I (3.1 g.) in 20 cc. H_2O was treated with 2.9 g. K 2-methyl-1,4-naphthoquinone-3-sulfonate (II), heated to 60–70° 10 min., with stirring, cooled, filtered, and the ppt. extd. with 20 cc. hot Me_2CO; the insol. material (0.04 g.) was pure I. The adduct (7 g.) in 25 cc. H_2O, 3.2 g. semicarbazide.HCl, and 4 g. NaOAc.$3H_2O$, allowed to stand at 10° 24 hrs., yielded 7 g. *semicarbazone*, $C_{12}H_{13}O_5N_5SNa.H_2O$, colorless, sol. in H_2O, insol. in EtOH. On boiling in H_2O this rapidly changes to I semicarbazone. The adduct of I (2 g.) in 8 cc. H_2O was refluxed 0.5 hr. (about 0.03 g. I ppts.) and the cooled soln., after addn. of 15 cc. satd. KCl soln., was treated with Cl until the brown-violet ppt. of the quinhydrone became light yellow; the ppt. after washing with satd. KCl, H_2O, and Me_2CO, was 0.68 g. II. I (3.4 g.) in 60 cc. EtOH (d. 0.85), treated below 15° with 2.4 g. $KHSO_3$ in 8 cc. H_2O, stirred 0.5 hr., let stand 1.5 hrs., filtered, and dild. with Et_2O, gave a small yellowish ppt., which was discarded, and the clear soln. after further dilu. with Et_2O and rubbing gave 1.75 g. colorless solid which was a mixt. of I-bisulfite complex with I-$KHSO_3$ adduct and gave a blue-green color with Fe^{+++} Cl_3 (typical of p-quinone complexes only). The complex in aq. soln. gradually isomerizes into the adduct, losing the capacity for $FeCl_3$ reaction; this is hastened by catalytic amts. of mineral acids. Because of ready isomerization it was impossible to isolate the complex without admixts. of the adduct. The complex is assumed to represent the resonant structural forms:

G. M. Kosolapoff



The principle and fundamental concepts of the resonance theory. D. A. Bochvar. *Uspekhi Khim.* 16, 129-39 (1947).—Exposition of the math. foundations of the quantum-mech. theory of valence structure resonance.
N. Thon



CA 2

Basic concepts of the theory of superposition of structures. D. A. Bochvar. *Uspekhi Khim.* 17, 17–44(1948). — Summary of theoretical methods concerning the principle of superposition of org. structures, with numerous references to recent publications on applications of quantum mechanics, resonance, and related topics. G. M. K.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BOCHVAR, D. A.

USSR/Chemistry - 1,4-Naphthoquinone Jan 1948
Chemistry - Hydrazine

"Research in the Field of Compounds of Quinoid Structure: II, Reaction of Some Bisulfite Derivatives of P-Naphthoquinone With Substituted Hydrazines," D. A. Bochvar, Ye. I. Vinogradova, Yu. B. Shvetsov, M. M. Shemyakin, Lab of Org Chem, Inst of Biol and Med Chem, Acad Med Sci USSR, and Chair of Anal Chem, Moscow Textile Inst, 11 pp

"Zhur Obshch Khim" Vol XVIII (LXXX), No 1

Study the interrelationship of various types of p-naphthoquinone derivative bisulfites containing replaceable hydrazines, and observe the properties of the hydrazines formed. Show fallacies contained in formulas suggested by Palladin for bisulfite produced 2-methyl-1,4-naphthoquinone and by Ufimtsev for bisulfite produced 2-methyl-1,4-naphthoquinone-3-sulfonate. Submitted 14 Jan 1947.

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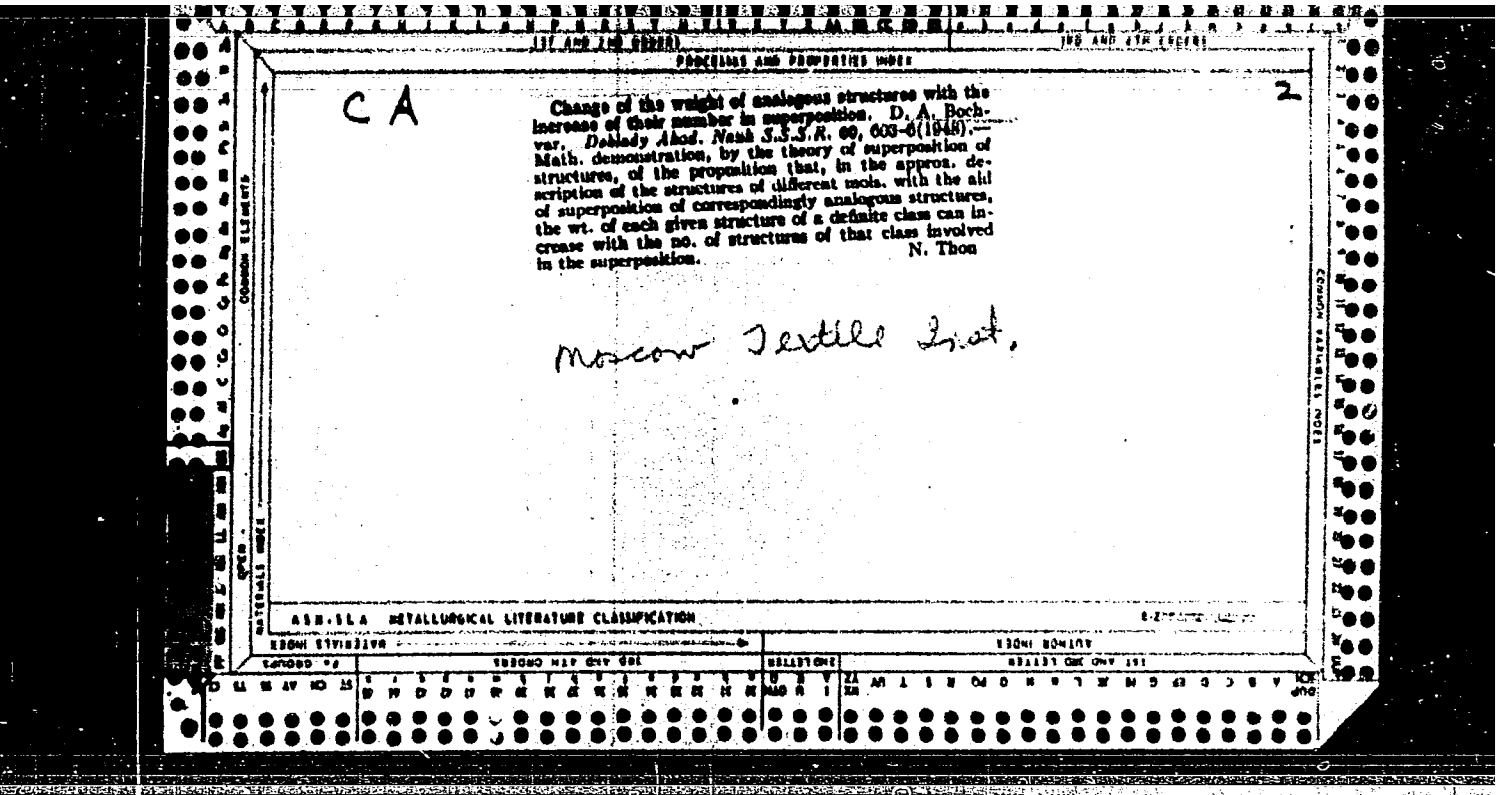
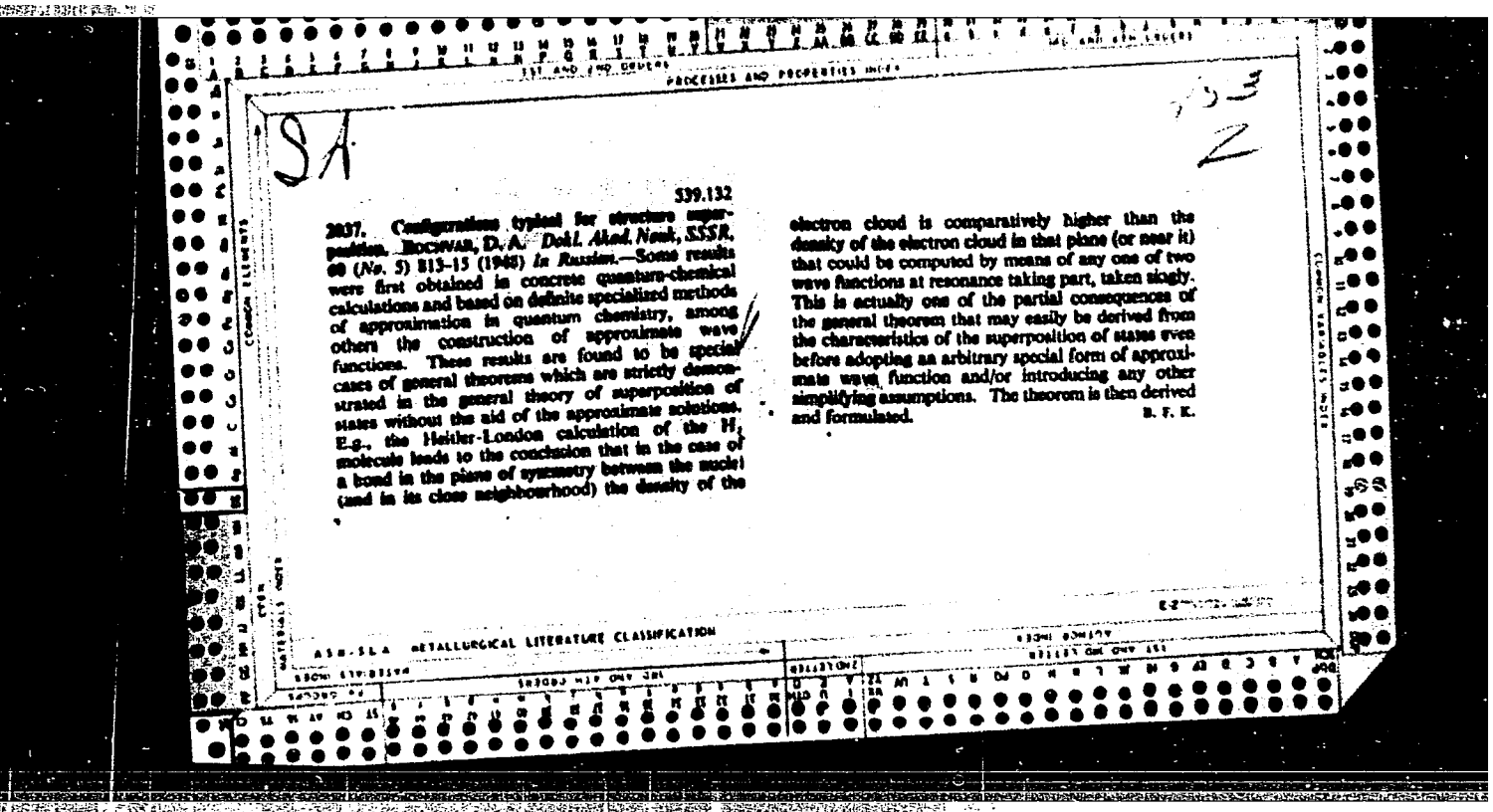


CA

2

Change of the weight of analogous structures with the increase of their number in superposition. D. A. Bochvar, *Doklady Akad. Nauk S.S.S.R.* 60, 603-6(1948).—Math. demonstration, by the theory of superposition of structures, of the proposition that, in the approx. description of the structures of different mols. with the aid of superposition of correspondingly analogous structures, the wt. of each given structure of a definite class can increase with the no. of structures of that class involved in the superposition. N. Thon

Moscow Textile Inst.



539.132

2837. **Configurations typical for structure superposition.** BOCHVAR, D. A. *Dokl. Akad. Nauk, SSSR*, 60 (*No.* 5) 813–15 (1948) *In Russian.*—Some results were first obtained in concrete quantum-chemical calculations and based on definite specialized methods of approximation in quantum chemistry, among others the construction of approximate wave functions. These results are found to be special cases of general theorems which are strictly demonstrated in the general theory of superposition of states without the aid of the approximate solutions. E.g., the Heitler-London calculation of the H_2 molecule leads to the conclusion that in the case of a bond in the plane of symmetry between the nuclei (and in its close neighbourhood) the density of the electron cloud is comparatively higher than the density of the electron cloud in that plane (or near it) that could be computed by means of any one of two wave functions at resonance taking part, taken singly. This is actually one of the partial consequences of the general theorem that may easily be derived from the characteristics of the superposition of states even before adopting an arbitrary special form of approximate wave function and/or introducing any other simplifying assumptions. The theorem is then derived and formulated. B. F. K.

Bochvar, D. A. Doc Chem Sci

Dissertation: "Investigation in the Field of the Superposition Theory of States."

25 May 49

Moscow Order of Lenin State U imeni M. V. Lomonosov.

SO Vecheryaya Moskva
Sum 71

CA

10

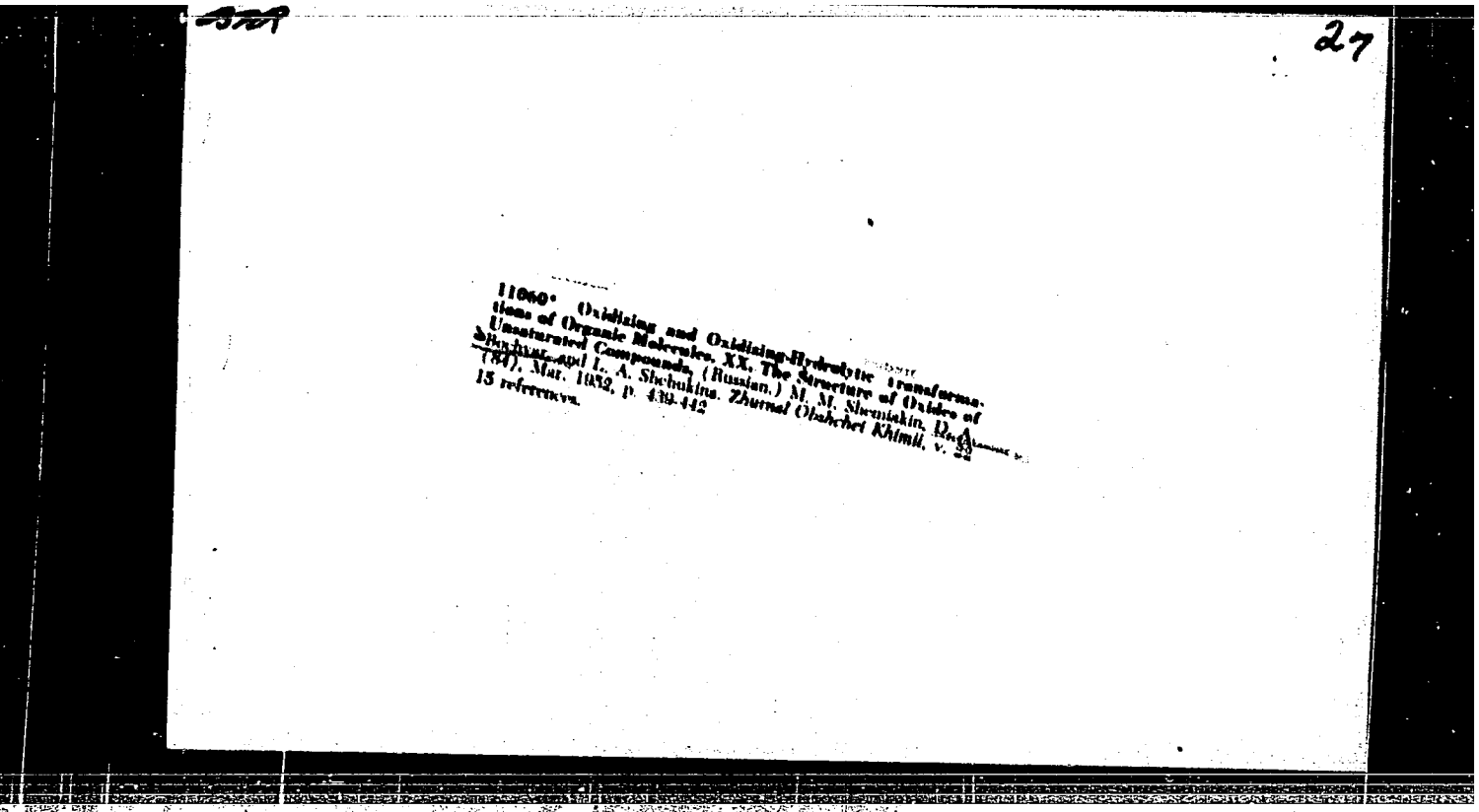
A note concerning the article by V. N. Ufimtsev on the bisulfite compound of 1,4-naphthoquinone. D. A. Bochvar, A. S. Chernyshev, and M. M. Shemyakin (Moscow Textile Inst.). *Zhur. Obshchei Khim.* (J. Gen. Chem.) 20, 2118-20(1950); cf. *C.A.* 41, 747g; U., *C.A.* 43, 2501f.—Polemical. The idea of formation of salts of 1,4-dihydro-1,4-dihydroxy-1,4-naphthalenedisulfonic acid by addn. of 2 moles of bisulfite to 1,4-naphthoquinone, described by U., is based on erroneous reasoning. There are 2 isomeric forms of the addn. product, which is poorly stable in aq. solns. and is prone to isomerize at a rate which depends greatly on the temp. The K complex of 1,4-naphthoquinone-2-sulfonate is best purified by pptn. from H_2O with Me_2CO; the product is $C_{10}H_6O_5S_2K_2$; the existence of the 2 forms is best shown by the reaction with 1,4-naphthoquinone-2-sulfonic acid (in the form of its K salt) with bisulfite.

G. M. Kosolapoff

BOCHVAR, D. A.

"The structure of bisulphite derivatives of aromatic compounds." E. M. Bamdas, D. A. Bochvar, and M. M. Shemyakin. (p. 1287)

SO: Journal of General Chemistry (Zhurnal Obshchei Khimii) 1951, Vol 21, No 7.



27

11660. Oxidizing and Oxidizing-Hydrolytic transformations of Organic Molecules. XX. The Structure of Oxides of Unsaturated Compounds. (Russian.) M. M. Shemiakin, D. A. Shchukina and L. A. Shchukina. Zhurnal Obshchei Khimii, v. 22 (84), Mar. 1952, p. 439-442

15 references.

BOCHVAR, D.A.

Periodic Law

Length of the period of D.I. Mendeleev's system a function of the maximum value for the azimuthal quantum number in the period
Zhur. Fiz. Khim. 26 no. 7, 1952

BUCHIKHIN, D.M.

Chemical Abst.
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Organic Chemistry

(4)

Oxidative and oxidative-hydrolytic transformations of organic substances. XX. The structure of oxides of nitrosated compounds. M. M. Shemyakin, D. A. Bochvar, and L. A. Shchukina (Moscow Textile Inst.). *J. Gen. Chem. U.S.S.R.* 22, 505–7(1952)(Engl. translation).—See *C.A.* 47, 2741*e*. XXI. Hydrolytic cleavage of 6-methyl-3-hydroxy-*p*-benzoquinone. L. A. Shchukina. *Ibid.* 733–8. See *C.A.* 47, 5378*d*. XXII. Hydrolytic and oxidative changes of 1-phenylazo-3,4-dihydroxynaphthalene. O. M. Shemyakina, E. M. Bogoslovskii, and M. M. Shemyakin. *Ibid.* 739–42. XXIII. Mechanism in the oxidative-hydrolytic and hydrolytic transformations of 2-chloro-3-hydroxy-1,4-naphthoquinone. D. P. Vitkovskii and M. M. Shemyakin. *Ibid.* 743–9. See *C.A.* 47, 5378*g*.

H. L. H.

БОЧВАР, Д.А.

USSR/ Physical Chemistry - Molecule. Chemical bond

B-4

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Author : Almazov A.B., Bochvar D.A.
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Title : On Calculation of π -Electron Density in Molecules of Unsubstituted Benzene on the Basis of a Metal Model

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Abstract : On the basis of a metal model, the question is considered concerning the influence of the nature of the substituent, in benzene, on distribution of π- electron density over the benzene ring. From the condition of symmetry of wave functions in relation to plane normal to the ring and extending through substituent and para-position to substituent, and from general characteristics of the solution of unidimensional equation of Schroedinger with symmetrical boundary conditions, follows the existence of an absolute maximum of density of π-electrons in para-position to substituent. Difference in potential between ring and substituent is represented by rectangular trough in unidimensional potential box. Variation of parameters of trough (or hill) has no effect on occurence of above-stated absolute maximum.

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